TD 9-6920-720-10
TM 6920/08953A-10/9

TECHNICAL MANUAL

OPERATOR'S MANUAL

MULTIPLE INTEGRATED LASER ENGAGEMENT SYSTEM (MILES 2000)

TACTICAL ENGAGEMENT SIMULATION SYSTEM (TESS)

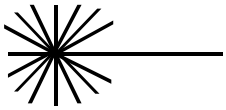
FOR

M1A1/M1A2 ABRAMS TANK

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS
You can help improve this manual. If you find any mistakes or you know of a way to improve the procedures, please let us know. Mail your letter, DA FORM 2028 (Recommended Changes to Publications and Blank Forms), or DA FORM 2028-2 located in back of this manual directly to Commander, Simulation, Training, and Instrumentation Command (STRICOM): ATTN: AMSTI-OPS-L; 12350 Research Parkway, Orlando, FL 32826-3276. Marine Corps users submit NAVMC 10772 to: Commander, Marine Corps Logistics Base (Code 826), 814 Radford Boulevard, Albany, GA 31704-1128.

HEADQUARTERS, DEPARTMENT OF THE ARMY AND UNITED STATES MARINE CORPS

27 MAY 2002



LASER WARNING

Suitable precautions must be taken to avoid possible damage to the eye from overexposure to radiated laser energy. Precautionary measures include the following:

- **NEVER fire the laser** at personnel within 10 meters.

- **NEVER look at the laser transmitter** through magnifying optics such as binoculars, telescopes, or periscopes at ranges less than 40 meters.

LIST OF EFFECTIVE PAGES

INSERT LATEST CHANGED PAGES. DESTROY SUPERSEDED PAGES

NOTE: The portion of the text affected by changes is indicated by a vertical line in the outer margins of the page. Changes to illustrations are indicated by miniature pointing hands. Changes to wiring diagrams are indicated by shaded areas.

Dates of issue for original and changed pages are:

Original . . . . . 0 . . . . . 7 December 1999
Change . . . . . 1 . . . . . 4 January 2002

TOTAL NUMBER OF PAGES IN THIS PUBLICATION IS 117 CONSISTING OF THE FOLLOWING:

Page No.	*Change No.	Page No.
Title	1	
A	1	
i – v	1	
vi Blank	1	
a - c	1	
d Blank	1	
1-1 - 1-22	1	
2-1 - 2-70	1	
3-1 - 3-11	1	
3-12 Blank	1	
Appendix A-1	1	

***Zero in this column indicates an original page**

TABLE OF CONTENTS

PAGE

TABLE OF CONTENTS-Continued

PAGE

TABLE OF CONTENTS-Continued

PAGE

Appendices

LIST OF FIGURES

LIST OF FIGURES-Continued

LIST OF TABLES

Intentionally left blank.

SAFETY SUMMARY

WARNING

- Tape primer is toxic and highly flammable. Do not spray near heat, open flame, or sparks. Use primer only in well ventilated areas. Do not permit smoking in the area. Injury to personnel may result.

- Personnel can be killed or injured by turret movement. Never install or remove MILES 2000 equipment in/on an M1A1/A2 Abrams and M2/M3 Bradley unless **TURRET TRAVERSE LOCK** is **LOCKED** and the **VEHICLE MASTER POWER** switch is **OFF**.

- Tankers must wear earplugs. Your hearing can be damaged by the Main Gun Signature Simulator (MGSS) and Direct/Indirect Fire Cue (DIFCUE) firing. All personnel within 26 meters of an armed MGSS or within four (4) meters of an armed DIFCUE area must wear single hearing protection. Keep ALL vehicle hatches closed when firing the Anti-Tank Weapons Effect Signature Simulator (ATWESS), MGSS or DIFCUE.

- Your hearing can be damaged by an ATWESS cartridge. All personnel within 90 meters of an armed ATWESS must wear hearing protection.

- To preclude fragmentation hazards, personnel shall not be closer than five (5) meters from an armed MGSS, two (2) meters from an armed DIFCUE, and 90 meters from an armed ATWESS.

- MILES equipment transit cases have a multiple personnel lifting requirement. Failure to use sufficient personnel could result in injury during installation or removal.

- Visually check to see if the firing pin is protruding. If it is, **DO NOT** install the ATWESS cartridge as serious personal injury may occur. Fill out the appropriate deficiency form, and return the weapon to the issue facility/authority. Sign out

- Use safe/proper handling procedures when removing undetonated ATWESS cartridges. Dispose of undetonated cartridges in accordance with local SOP.

- To prevent personal injury, turn all system power off on the CU before conducting and removal/replacement procedures.

FIRE/EXPLOSION WARNING

- Personnel can be killed, burned, or otherwise injured if a pyrotechnic charge in an ATWESS, MGSS or DIFCUE accidentally ignites or explodes.
- **NO SMOKING, heat, or open flame,** within 50 feet of an ATWESS, MGSS or DIFCUE.
- A strong shock can set off an ATWESS, MGSS or DIFCUE pyrotechnic cartridge. Treat ATWESS, MGSS and DIFCUE cartridges as standard ammunition.
-
- Hook and loop tape primer is toxic and highly flammable. Do not spray near heat, sparks, or open flame. Use only in well-ventilated areas.

CAUTION

- Any batteries or otherwise hazardous materials replaced as routine maintenance should be disposed of through local government personnel.
- Ensure battery door is securely closed during storage and operations, or damage can occur to the battery door.
- Use care when starting capscrew not to cross threads. **DO NOT** use any tools to tighten capscrews at this time.
- To avoid damaging the belt, place the belt two (2) inches away from the rear edge of the sliding mantle plate.
- Blank fire can heat up the barrel and damage the cable if the cable touches the barrel.

For information on **FIRST AID**, refer to **FM 21-11/MCRP-3-02G**.

- To operate the IWS, refer to TD 23-6920-703-10/TM 6920/07722B-10/13, IWS operator's manual.
- To operate the DIFCUE, refer to TD 9-6920-893-10/TM 6920-10/5, DIFCUE operator's manual.
- To operate the MGSS, refer to TD 9-6920-892-10/TM 6920/08953A-10/11.

HOW TO USE THIS MANUAL

INTRODUCTION

This manual contains operation instructions for the Multiple Integrated Laser Engagement System (MILES 2000), Tactical Engagement Simulation System (TESS), when configured with the M1A1/M1A2 Abrams Tank.

MANUAL DESCRIPTION

This manual is divided into three chapters. Chapters are further divided into sections. The chapter descriptions are provided in the following subparagraphs.

Chapter 1 is an introduction that provides general information, equipment description and theory of operation. It also contains a list of abbreviations and a glossary of terms.

Chapter 2 provides operating instructions for the MILES 2000 equipment.

Chapter 3 describes how to troubleshoot and maintain the equipment. MILES 2000 equipment does not need operator maintenance or lubrication, except for external cleaning after use.

Intentionally left blank.

CHAPTER 1
INTRODUCTION

SECTION I. GENERAL INFORMATION

1.1 SCOPE

This manual describes how to install, operate, and maintain the Multiple Integrated Laser Engagement System (MILES 2000), Tactical Engagement Simulation System (TESS), when configured with the M1A1/M1A2 Abrams Tank. The manual also explains all authorized operator maintenance. Refer any maintenance problems not covered to organizational maintenance personnel.

1.1 MAINTENANCE FORMS AND RECORDS

Department of the Army forms and procedures used for equipment maintenance will be those described by DA PAM 738-750, The Army Maintenance Management System (TAMMS). Marine Corps personnel will use TM 4700-15/1, Equipment Record Procedures, and refer to the on-line MCPDS or Marine Corps Stocklist SL-1-2, Index of Technical Publications.

1.3 REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIRS

If the MILES 2000 equipment for the M1A1/M1A2 needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on a Quality Deficiency Report. Mail to us at Commander, Simulation, Training, and Instrumentation Command (STRICOM): ATTN: AMSTI-OPS-L: 12350 Research Parkway, Orlando, FL, 32826-3276. We'll send you a reply. For U.S. Marine Corps personnel, submit SF-368 in accordance with MCO 4855.10 (Quality Deficiency Report) to: Commander, Marine Corps Logistics Base (Code G316-1), 814 Radford Boulevard, Albany, GA 31704-1128.

1.4 CORROSION PREVENTION AND CONTROL

a. Corrosion Prevention and Control (CPC) of Army material is a continuing concern. It is important that any corrosion problems with this item be reported so that the problem can be corrected and improvements can be made to prevent the problem in the future.

b. While corrosion is typically associated with rusting of metals, it can also include deterioration of other materials such as rubber and plastic. Unusual cracking, softening, swelling or breaking of these materials may be a corrosion problem.

c. If a corrosion problem is identified, it can be reported using form SF-368. Use of key words such as "corrosion," "rust," "deterioration," or "cracking" will assure that the information is identified as a CPC problem.

d. The form should be submitted to Commander, Simulation, Training, and Instrumentation Command (STRICOM): ATTN: AMSTI-OPS-L; 12350 Research Parkway, Orlando, FL 32826-3276. U.S. Marine Corps personnel, submit SF-368 in accordance with MCO 4855.10 (Quality Deficiency Report).

1.5 PREPARATION FOR STORAGE OR SHIPMENT

When receiving equipment for storage or shipment, always inspect the returned equipment for damage, breaks, cracks, and cleanliness.

1.6 LIST OF ABBREVIATIONS AND GLOSSARY

Refer to Table 1-1 for the list of abbreviations used in this manual and refer to Table 1-2 for the glossary.

Table 1-1. List of Abbreviations.

AAV	Assault Amphibious Vehicle
AC-DC	Alternating Current/Direct Current
ASAAF	Automatic Small Arms Alignment Fixture
ATWESS	Anti-Tank Weapons Effects Signature Simulator
AVCPS	Audio Visual Cue Pyrotechnic Simulator
BFA	Blank Firing Adapter
BIT	Built-In-Test
CD/TDTD (Controller Gun)	Controller Device/Training Data Transfer Device
CDA	Control Display Assembly
CPC	Corrosion Prevention and Control
CSWS	Crew Served Weapon System
CU	Control Unit
CVC	Combat Vehicle Crew
CVS	Combat Vehicle System
DC-DC	Direct Current/Direct Current
DIFCUE	Direct/Indirect Fire Cue
DPCU	Data Processing Control Unit
EIR	Equipment Improvement Recommendation
EOD	Explosive Ordnance Disposal
FCU	Fire Control Unit
FlashWESS	Flash Weapons Effects Signature Simulator
FU	Firing Unit
ID	Identification
I/O	Input/Output
IR	Infrared
ISU	Integrated Sight Unit
ITS	Independent Target System
IWS	Individual Weapons System
IWS Console (DPCU)	Individual Weapons System Console (Data Processing Control Unit)

Table 1-1. List of Abbreviations - Continued.

KSI	Kill Status Indicator
LAV	Light Armored Vehicle
LASER	Light Amplification by Simulated Emission of Radiation
LED	Light Emitting Diode
LTU	Laser Transmitter Unit
LU	Loader Unit
MARS	MILES After-Action Review System
MCS	Master Control Station
MG	Machine Gun
MGS	Missile Guidance System
MGSS	Main Gun Signature Simulator
MILES	Multiple Integrated Laser Engagement System
O/C	Observer Controller
OTPD	Optical Turret Positioning Device
PID	Player Identification
Pk	Probability of Kill
PMCS	Preventive Maintenance Checks and Services
PROM	Programmable Read-Only Memory
SAT	Small Arms Transmitter
SMAW	Shoulder-Mounted Assault Weapon
SWS	Surrogate Weapons System
TAMMS	The Army Maintenance Management System
TESS	Tactical Engagement Simulation System
TNB	Turret Network Box
TOW	Tube-Launched Optically-Tracked Wire-Guided Weapon System
ULT	Universal Laser Transmitter
Vac	Volts Alternating Current
Vdc	Volts Direct Current

Table 1-2. Glossary.

Administrative Kill	A kill assessed by a Controller for administrative purposes.
Automatic Small Arms Alignment Fixture (ASAAF)	Device used to align the Small Arms Transmitter (SAT) to the sights on a weapon.
Catastrophic Kill	A kill that totally disables a vehicle or individual.
Cheat Kill	A kill is assessed to a system when a tamper attempt has been detected.
Commo Kill	A kill that disables external communications.
Commo Override	Use the Control Unit **USER INFO/ENTER** push button to override the communications disable function under Communications/ Catastrophic Kill conditions in an emergency
Controller	An umpire or referee in a MILES 2000 training exercise.
Controller Device (CD/TDTD)	A device used by the Controller to upload, download and test the MILES 2000 system. (Controller Gun)
Direct/Indirect Fire Cue (DIFCUE)	A device that produces flash, noise, and smoke to simulate a vehicle being hit by direct or indirect fire.
Fastener Tape	A hook and pile type tape used to hold vehicle detector belts and other MILES 2000 equipment in place.
Firepower Kill	A kill that disables vehicle weapons.
Helmet Harness	The part of the IWS attached to the helmet or soft cover.
Hit	Simulated contact with incoming fire that does not result in a Kill.
Individual Weapons System (IWS)	The Helmet and Torso Harness assemblies and IWS Console (DPCU), which is worn by personnel. This equipment also includes the Small Arms Transmitter (SAT).
Kill	Refer to Catastrophic Kill, Commo Kill, Firepower Kill, or Mobility Kill
Kill Status Indicator (KSI)	A device attached to a vehicle that produces an external flashing light indicating a Hit, Near Miss or Kill.
LASER	Light Amplification by Simulated Emission of Radiation. A narrow beam of light capable of transmitting information.
Laser Beam	In MILES 2000 equipment, an eye-safe, invisible beam of light that simulates weapons fire.
Laser Detector	A device that senses incoming laser beams.
Laser Transmitter	A device that transmits a laser beam.
Main Gun Signature Simulator (MGSS)	A device that produces a flash and bang to simulate main gun firing.
Mobility Kill	A kill that disables the vehicle movement. The crew has 20 seconds to bring the vehicle to a stop. If motion is sensed after the 20 seconds, a Cheat Kill will occur.
Near Miss	Laser fire close enough to be sensed by a laser detector, but not close enough to cause a Hit or Kill.

Table 1-2. Glossary - Continued.

Optical Turret Positioning Device (OTPD)	A device that provides an optical reference signal to the turret detector belts (on applicable vehicles) to determine the turret position with reference to the hull.
Reset	Brings the system to the ready (alive) condition. In a CVS, the reset brings the system to a ready condition and returns ammunition to the default levels.
Resurrect	When a CVS is resurrected, the system is brought to a ready condition, but the ammunition levels remain as they were when the system was killed.
Small Arms Transmitter (SAT)	A laser transmitter used on various individual and vehicle-mounted rifles and machine guns.
Torso Harness	The part of the IWS that is worn on the upper body.
Universal Laser Transmitter (ULT)	A laser transmitter used on various combat vehicle systems mounted on the main gun and the coax machine gun.
Weapon Token	Is embedded in software and allows the IWS Console (DPCU) to enable a SAT. The Weapon Token is transmitted to the IWS when the system is reset/resurrected by the CD/TDTD. The SAT cannot be enabled without a Weapon Token and will not have one in the following conditions: system is killed or another SAT is enabled with the same Torso Harness.

NOTE

Army vehicle kits contain the SATs for the vehicle mounted weapons, but do not include IWS SATs. Marine Corps vehicle kits do not include any IWS items.

1.7 SAFETY, CARE, AND HANDLING

Before, during and after operation of equipment, read and adhere to all applicable WARNINGS and CAUTIONS. Perform all preventive maintenance checks and services as scheduled, and report any discrepancies as soon as possible. Use the proper tools and procedures for installation, troubleshooting, removal and replacement of components, and notify higher echelon maintenance personnel when warranted.

Although MILES 2000 consists of ruggedized equipment, designed to withstand extreme vibration, shock, and environmental stresses, treat the equipment with reasonable care; do not use excessive force when handling, packing, or stowing equipment. Responsible handling and use will help prolong the life cycle and appearance of the equipment.

SECTION II. EQUIPMENT DESCRIPTION AND DATA

1.8 EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES.

1.8.1 Equipment Characteristics.

The MILES 2000 M1A1/M1A2 system permits the vehicle and crew to take part in realistic combat training exercises. Actual firing conditions of all vehicle weapons are simulated using laser beams. Blank ammunition, a Main Gun Signature Simulator (MGSS), and a Direct/Indirect Fire Cue (DIFCUE) add to the system's realism.

Laser detectors, mounted on the M1A1/M1A2 and worn by crew members, sense opposing fire. The MILES 2000 system electronics determines the accuracy and simulated damage of opposing fire. The system also detects the type of weapon directing fire against the M1A1/M1A2.

1.8.2 Capabilities and Features.

a. Easily installed and removed.

b. Simulates firing capabilities of the 120 mm main gun, coax machine gun, and the M2 and M240 machine guns.

c. Blank-Fire; MGSS and DIFCUE, if used, add realism to weapon use.

d. Normal firing procedures used for all weapons.

e. Detects all incoming fire, identifies opposing weapons and Player ID (PID), and determines the effect of incoming fire on the using vehicle.

f. Uses eye-safe laser transmitters.

g. Uses high visibility KSI strobe light signals vehicle Near Miss, Hit, or Kill.

h. Compatible with all other MILES devices.

1.9 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

NOTE

MILES equipment installation procedures should be followed as outlined in the technical manual. If the following procedures CANNOT be followed due to cable length or additional vehicle equipment, then place the MILES equipment in the best and safest location.

a. M2 and M240 Small Arms Transmitter (SAT): Adaptation for the specific weapon is through a factory set laser power adjustment, modifying the encoded personality Programmable Read-Only Memory (PROM), and attaching the weapon specific mounting adapter. The laser power is adjusted to represent the specific weapon type and simulate its firing capabilities. A window for the infrared link transmitter and receiver, and a sunlight readable firing indicator is located in the rear cover. The SAT is powered by an internal 3.6-volt lithium battery. The M2 SAT mounts on the machine gun cooling jacket. The M240 SAT adapter attaches to the machine gun barrel.

b. Individual Weapons System (IWS): The IWS portion of the M1A1/M1A2 system consists of a Helmet Harness, a Torso Harness with IWS Console (DPCU), a Small Arms Transmitter (SAT), and fastener tape to secure the Helmet Harness. The harness set has the following:

(1) Detectors - receive coded messages from laser transmitters.

(2) Amplifier - amplifies coded messages received from incoming laser transmitters and forwards them to the IWS Console (DPCU) for decoding.

(3) Infrared (IR) Transmitter - transmits information which links the Torso Harness and the weapon's SAT.

(4) Audio Alarm [on the IWS Console (DPCU)] - indicates the laser signal received.

(5) Helmet Inductive Loop - transfers information from the Helmet Harness detectors to the Torso Harness, IWS Console (DPCU) for processing. The Helmet Harness Amplifier is powered by an internal 3.6-volt lithium battery with a three (3) year battery life.

(6) IWS Console (DPCU) - Data Process Control Unit for the IWS - provides user interface and decodes the laser and IR transmitted data for the IWS. Powered by a 9-volt battery with approximately 72 hours battery life (PN 147421), or by an internal 3.6-volt lithium battery with approximately 12-month battery life (PN 148245).

(7) Small Arms Transmitter (SAT). Adaptation for the specific weapon is through a factory set laser and attaching the weapon specific mounting adapter. The laser power is factory adjusted to represent the specific weapon type and simulate its firing capabilities. The SAT is powered by an internal 3.6-volt lithium battery with a three (3) year battery life.

c. Vehicle Detector Belts and Amplifier: Two (2) vehicle detector belts provide detection coverage for each aspect of the vehicle's vulnerability zones.

d. Kill Status Indicator (KSI): The KSI is an integrated status indicator that provides information to an attacking vehicle. The KSI is composed of two major functional elements: a visual strobe and the decoder/interface electronics. The KSI also includes the interface inputs for the DIFCUE and MGSS trigger, and the serial bus interface and the optical I/O port. The optical I/O port provides the optical interface to the Controller Device/Training Data Transfer Device (CD/TDTD) for transfer of vehicle types/PK data uploading and events downloading. The KSI also includes a motion sensor to detect vehicle motion after a Mobility Kill to allow the Control Unit (CU) to assess a Cheat Kill if vehicle motion occurs after 20 seconds. The KSI is mounted to the bustle rack.

e. Main Gun Signature Simulator (MGSS) (if used): The optional MGSS consists of two (2) units: the Fire Control Unit (FCU) and the Firing Unit (FU). The MGSS simulates the main gun firing of the M1A1/M1A2 using pyrotechnics. It gives an audio (bang) and visual (smoke) indication for realism when simulating weapons fire. The MGSS FU is mounted on the left front side of the turret of the M1A1/M1A2; the FCU is mounted on the right wall of the gunner's station.

f. Direct/Indirect Fire Cue (DIFCUE), (if used): The optional DIFCUE consists of two (2) units: the Fire Control Unit (FCU) and the Firing Unit (FU). The DIFCUE simulates the vehicle receiving a direct/in-direct hit from incoming rounds. It gives an audio (bang) and visual (smoke) indication when a vehicle is hit. The DIFCUE FU is installed on the left rear side of the turret of the M1A1/ M1A2. The FCU is installed on the right wall of the gunner's station.

g. Coax Microphone: Picks up the sound of the blank fire which causes the ULT on the main gun to fire. The Coax Microphone is mounted on the gas tube under the barrel of the coax machine gun.

h. Universal Laser Transmitter (ULT): The ULT is a laser transmitter for use on the 120 mm main gun and coax machine gun on the. The transmitter has adjustable laser power that is set to a level representative of the weapon being simulated. The assembly is mounted to an adapter which in turn is mounted in the breech of the main gun. The coax microphone picks up the sound of blank fire and machine gun trigger, which causes the ULT on the main gun to fire.

i. Control Unit (CU): Contains all the primary user interface functions, displays and controls. Weapon selection, ammo selection, loading/reloading of ammunition, and weapon status are functions provided by the CU. The unit is mounted inside the commander's station using fastener tape. The CU is capable of being configured for four (4) types of ammunition: APFSDS, HEAT, MPAT, and STAFF.

j. Power Controller: The Power Controller assembly provides 24 Vdc, the charging voltage for the internal lead acid batteries, as well as power to the MILES 2000 system. The 24-volt battery is converted to 10.5 Vdc output by a DC-DC converter for use by the MILES 2000 kit, and provides backup power for 100 hours. The battery also supplies power to the KSI for a 10 minute time period in the event the vehicle's power is turned off and the vehicle is killed. The Power Controller is installed on the shelf of the turret near the AM 1780/MCS.

k. Loader Unit (LU): The LU provides all loader functions including display and controls in the M1A1 and M1A2 tanks. It allows the crew to perform tasks that simulate the tactical routine the loader would normally perform, such as weapon selection, ammunition selection, weapon loading/reloading, weapon status, and display of ammunition. The unit is installed with fastener tape at the loader station between the ammo door and the AM 1780/MCS.

l. Optical Turret Positioning Device (OTPD): The OTPD transmits a MILES code and unique PID to the detector belts located on the vehicle in order to determine turret position with reference to the hull. The OTPD is powered by a 9-volt battery, and attaches to the left rear corner of the hull.

1.10 EQUIPMENT DATA

Table 1-3 defines the equipment data.

Table 1-3. Equipment Data.

EQUIPMENT	WEIGHT (POUNDS)	DIMENSIONS L x W x D (INCHES)	MAX EFFECTIVE RANGE (METERS)
120 mm/Coax Machine Gun Universal Laser Transmitter (ULT)	7.7	3.2 x 4.5 x 16	3000/800
M2 Machine Gun Small Arms Transmitter (SAT)	0.4	1.3 x 1.0 x 2.8	1000
M240 Machine Gun SAT	0.4	1.3 x 1.9 x 2.8	800
EQUIPMENT	**WEIGHT (POUNDS)**	**DIMENSIONS L x W x D (INCHES)**	**NOTES**
Right Front Detector Belt	4.0	341.88 x 2.0	
Left Rear Detector Belt	4.0	282.99 x 2.0	
IWS Helmet Harness	0.9	7.6 x 3.4 x 1.7	
IWS Torso Harness	3.3	24.0 x 7.6 x 1.7	
IWS Console (DPCU)	0.9	3.1 x 2.4 x 1.4	
Kill Status Indicator (KSI)	4.7	8.4 x 8.5 x 6.4	
Control Unit (CU)	1.0	4.2 x 5.4 x 2.2	
Loader Unit (LU)	0.9	4.2 x 5.4 x 2.2	
Power Controller	7.9	6.1 x 5.9 x 3.0	
Optical Turret Positioning Device (OTPD)	1.01	2.0 x 6.3 (dia)	

SECTION III. THEORY OF OPERATION

1.11 BASIC PRINCIPLES OF OPERATION.

1.11.1 Principles of Operation (MILES 2000). The MILES 2000 system uses laser beams to simulate actual weapons fire. An eye-safe invisible laser beam is sent out by each weapon's transmitter when it is fired. The laser beam is coded and simulates all of the weapon's capabilities including range, accuracy, and destructive capability.

Laser detector systems are used to sense opposing fire. The detector systems register incoming laser beams and determine whether they have scored a Near Miss, Hit, or Kill. Incoming fire can result in more than one type of a Hit or Kill. Types of hits or kills include Mobility, Communications, Firepower, or a Catastrophic Kill of the entire vehicle.

Table 1-4 defines the Kill Indication Chart.

M1A1/M1A2

1.11.2 Principles of Operation. All weapons on the M1A1/M1A2 Abrams (Figure 1-1) are equipped with laser transmitters that are fired using normal weapon operating procedures. The turret has detector belts attached that sense opposing fire. A Control Unit (CU) mounted inside displays the extent of opposing fire and its effect. The Kill Status Indicator (KSI) is activated by the CU when incoming fire is detected**.**

1.11.2.1 Main Gun Firing. The main gun is fired using normal procedures. A Main Gun Signature Simulator (MGSS) is used to add realism to the main gun firing. When the trigger is operated, both the MGSS, mounted on the turret, and the Universal Laser Transmitter (ULT), mounted in the gun breech, are fired together**.**

There is an 8 second wait after firing the main gun before it can be fired again. This simulates the time normally required to reload the weapon. The MILES 2000 system allows a basic load of 42 rounds for the 120 mm gun. The CU and Loader Unit (LU) display the number of rounds the MILES 2000 system has remaining.

1.11.2.2 M240 Coax Machine Gun. The M240 coaxial machine gun is fired using normal procedures. The gun is fitted with a Blank Fire Adapter (BFA) and loaded with blank ammunition. The sound of blank fire is sensed by a microphone that triggers the ULT in the main gun breech. The laser transmitter will operate as long as blank ammunition is being fired.

1.11.2.3 Loader M240 Machine Gun. The loader M240 machine gun is fired using normal procedures. The gun is fitted with a BFA and loaded with blank ammunition. The sound/flash of blank fire is sensed by the M240 machine gun SAT mounted on the machine gun's barrel. The laser transmitter will operate as long as blank ammunition is being fired.

1.11.2.4 Commander's M2 Machine Gun. The commander's M2 machine gun is fired using normal procedures. The gun is fitted with a BFA and loaded with blank ammunition. The sound/flash of blank fire is sensed by the M2 SAT mounted on the machine gun's cooling jacket. The laser transmitter will operate as long as blank ammunition is being fired.

Table 1-4. Kill Indication Chart.

Type of Hit/Kill	Number of KSI Flashes	Audible Indication
Vehicle		
SMAW Spotting Rifle	1 Flash	None
Near Miss	2 Flashes	Near Miss
Hit	4 Flashes	Hit
Mobility Kill	4 Flashes	Hit, Mobility. Stop Vehicle. (The crew has 20 seconds to bring the vehicle to a stop.)
Fire Power Kill	4 Flashes	Hit, Fire Power
Communications Kill	4 Flashes	Hit, Commo Kill. (Disables external communications only)
Catastrophic Kill	Flashes Continuously	Vehicle Kill
Administrative Kill	Flashes Continuously	Vehicle Kill
Cheat Kill	Flashes Continuously	Cheat Kill
Reset	1 Flash	Reset/Resurrect
IWS		
Near Miss	N/A	2 Beeps
Kill	N/A	Continuous
Administrative Kill	N/A	Continuous
Cheat Kill	N/A	Continuous
Reset	N/A	4 Beeps

Notes: Cheat Kill will occur during a Mobility Kill if the vehicle does not stop within the allotted 20 seconds or moves after it has stopped. A Cheat Kill will occur when disconnecting any of the following pieces of vehicle equipment: KSI, any Detector Belt/Array, or Power Controller (must be reconnected for cheat to be indicated), or removing the battery on IWS Console (DPCU).

In the event of a Catastrophic or Communications Kill, external communications can be over-ridden for **EMERGENCIES ONLY** by pressing the USER INFO push button on the Control Unit, selecting communication override and pressing the ENTER push button.

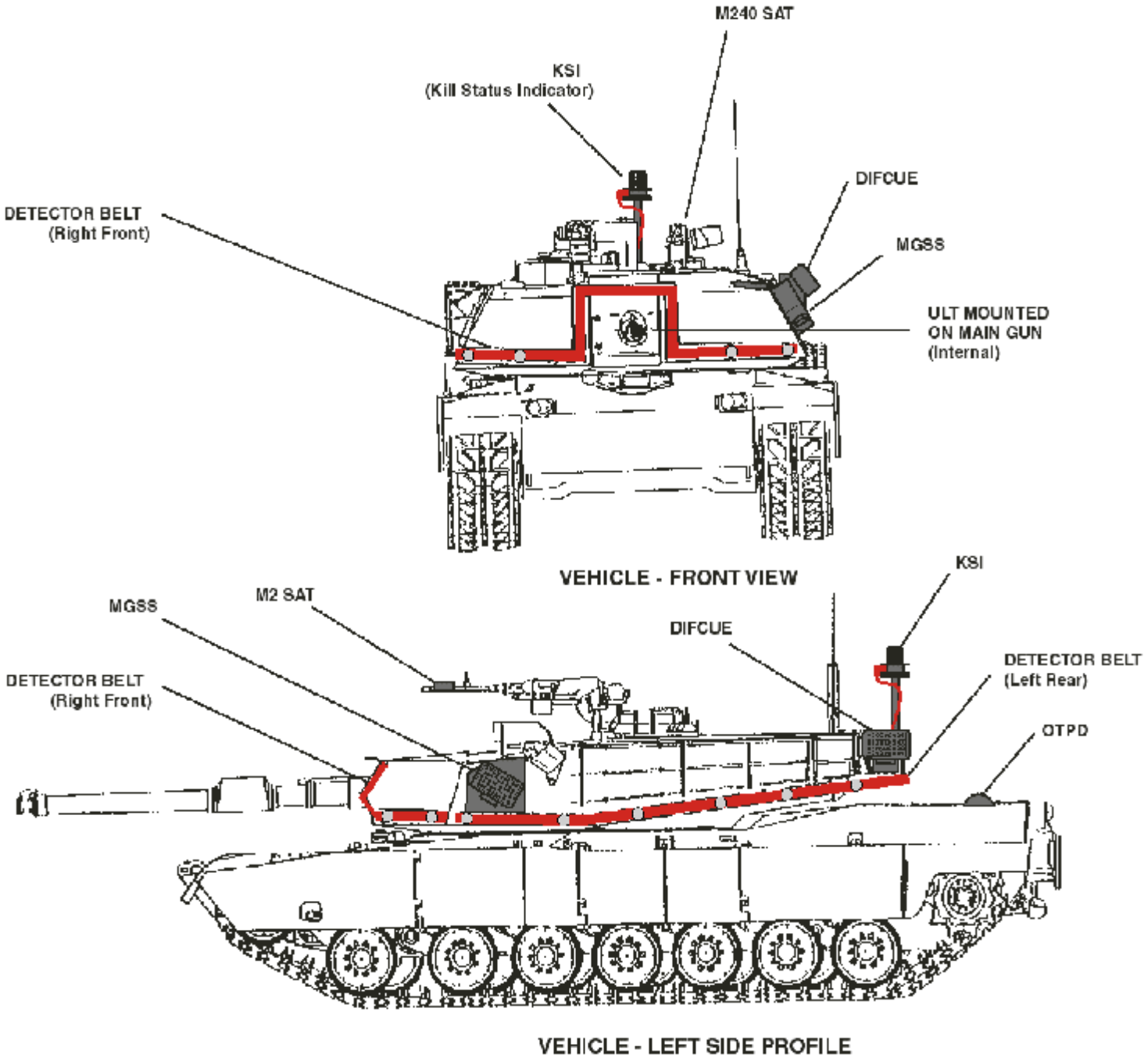


Figure 1-1. M1A1/M1A2 Abrams.

1.11.2.5 Individual Weapons System (IWS). Each crewmember of the M1A1/A2, except the driver, wears a Helmet Harness equipped with laser detectors, a Torso Harness equipped with laser detectors and an IWS Console (DPCU) with an audio alarm. When the detectors on the IWS system sense incoming fire, one of three things will happen:

a. If the alarm on the IWS Console (DPCU) sounds briefly two (2) times - a Near Miss occurred.

b. If the SAT has been enabled and the soldier has been killed, the alarm on the IWS Console (DPCU) will sound continuously until the SAT has been located and disabled.

c. If the alarm on the IWS Console (DPCU) sounds briefly four (4) times - the IWS has been reset by the controller.

1.11.2.6 Detector Belt System Two (2) detector belts are mounted on the turret and bustle rack of the M1 tank, which sense incoming fire. Each belt is electrically divided into two (2) zones for a total of four (4) zones, which represent the sides of the vehicle. They generate electrical signals that are fed to a decoder in the KSI.

1.11.2.7 Kill Status Indicator (KSI). Receives MILES messages from the detector belts, decodes them, and then routes all valid messages to the Control Unit (CU). It has an optical port for external interface with the CD/TDTD, a motion sensor, and provides trigger signal to the MGSS/DIFCUE. It is mounted to provide 360 visibility of the flashing light. Refer to Table 1-4 Kill Indication Chart for a list of the types of kills and the KSI indications.

1.11.2.8 Main Gun Signature Simulator (MGSS. The MGSS Firing Unit (FU), is mounted on the left side of the turret. When the main gun is fired, a signal is sent to the MGSS FU. The FU activates a pyrotechnic that simulates the smoke, flash, and bang of the main gun being fired, and sends a signal to the Fire Control Unit (FCU) to decrease a round.

1.11.2.9 Direct/Indirect Fire Cue (DIFCUE). The DIFCUE FU is mounted on the left side of the bustle rack of the tank. When the MILES 2000 system detects incoming fire, which results in a Catastrophic Kill, the DIFCUE FU activates a pyrotechnic to simulate a hit on the tank, then sends a signal to the FCU to decrease a round**.**

NOTE

A different location for the DIFCUE FU may be necessary on vehicles equipped with an Auxiliary Power Unit.

1.11.2.10 Coax Microphone. The Coax Microphone picks up the sound of the trigger and blank fire, and causes the ULT on the main gun to fire. The Coax Microphone is mounted on the gas tube under the barrel of the machine gun.

1.11.2.11 Universal Laser Transmitter (ULT). The ULT has the capability of adjusting laser power to simulate the range of various weapon types. It is boresighted using two knobs located on the rear of the ULT.

1.11.2.12 Control Unit (CU). The CU provides the following: casualty assessment using Probability of Kill (Pk) tables, records/stores event data (500 events max), provides system real time clock, monitors system for hardware failures and for cheat attempts, commands KSI to flash, and interrupts vehicle external communications during Communications/Catastrophic kills.

1.11.2.13 Power Controller. The Power Controller contains a rechargeable battery pack and operates from the vehicle power to maintain the battery charge. It automatically switches to the internal battery to provide power when the vehicle power drops lower than the internal battery power or when the vehicle power is removed from the MILES

1.11.2.14 Loader Unit (LU). The LU provides the selection of weapon/ammunition type. Displays ammunition selected/remaining, weapon selected and reloading status. Decreases the remaining ammunition count when commanded by the CU. When the coax machine gun is selected, the LU will not interact with it, nor will it display an ammunition count when firing blanks. It allows the review of the 16 most recent events stored at the CU.

1.11.2.15 Optical Turret Positioning Device (OTPD). An OTPD located on the back of the hull allows the CU to calculate and adjust the effect of laser fire on the tank based on the position of the turret with respect to the hull. The OTPD sends Infrared (IR) signals to the detectors on the turret, letting the CU know the relationship between any side of the turret and the hull. When a specific part of the turret is hit with laser fire, the CU determines which side of the hull is facing the fire.

Table 1-5. Kit/Equipment List.

PACKAGE NOMENCLATURE: SIMULATION SYSTEM, COMBAT VEHICLE SYSTEM, M1A1 TANK VIC COMM SYSTEM

PACKAGE PERTAINS TO: 146400-1

PACKAGE CONTENTS

QUANTITY	NAME OF ITEM	DWG NO.	PART NO.	NOTES
1	CONTROL UNIT ASSEMBLY	146402	146402-1	
1	LOADER UNIT ASSEMBLY	146407	146407-1	
1	KILL STATUS INDICATOR	271105	271105-1	
1	ULT/ADAPTER ASSY, 120MM CANNON	146405	146405-1	
1	POWER CONTROLLER ASSY	146409	146409-1	
1	CABLE ASSY, INTERNAL/EXTERNAL M1A1	146410	146410-1	
1	DETECTOR BELT ASSY, L-REAR M1A1/A2	146440	146440-1	
1	DETECTOR BELT ASSY, R-FR M1A1/A2	146442	146442-1	
1	OPTICAL TURRET POSNG DEVICE ASSY	146408	146408-1	
1	MAST ASSY, KSI	146403	146403-1	
1	CABLE ASSY, COAX MICROPHONE	146430	146430-1	
1	SAT ASSY, M 2	147571	147571-2	
1	SAT ASSY, M 240	147576	147576-2	
4	DETECTOR ASSEMBLY, TORSO	147421	147421-1	
4	DETECTOR ASSEMBLY, HELMET	147422	147422-1	
8	WEDGE ASSY, DETECTOR BELTS	146435	146435-1	
1	TRANSIT CASE, M1A1	146425	146425-1	4
AR	OPERATOR'S MANUAL		TD 9-6920-720	
1	GROMMET, PERISCOPE SEAL	146509	146509-8	
4	STRAP, BLK, 3/4" X 6"			1
4	STRAP, BLK, 3/4" X 8"			2
2	STRAP, BLK, 3/4" X 12"			3

NOTES:

1. MAY BE PURCHASED IN BULK QUANTITY AS PART OF VELCRO USA, CAGE CODE 11153, PART NO. 170790. THIS REEL CONSISTS OF 1200 STRAPS.
2. MAY BE PURCHASED IN BULK QUANTITY AS PART OF VELCRO USA, CAGE CODE 11153, PART NO. 170091. THIS REEL CONSISTS OF 900 STRAPS.
3. MAY BE PURCHASED IN BULK QUANTITY AS PART OF VELCRO USA, CAGE CODE 11153, PART NO. 170782. THIS REEL CONSISTS OF 600 STRAPS.
4. MARK THE TRANSIT CASE (2 PLACES) WITH THE APPLICABLE DASH NO. AFTER THE BASIC PART NUMBER. THE MARKING SHALL BE 6.35mm HIGH CHARACTERS MINIMUM, COLOR WHITE NO. 27925 IN ACCORDANCE WITH FED-STD-595 LOCATE AS SHOWN ON TRANSIT CASE DRAWING.

Table 1-5. Kit/Equipment List - Continued.

PACKAGE NOMENCLATURE: SIMULATION SYSTEM, COMBAT VEHICLE SYSTEM, M1A1 TANK VIS COMM SYSTEM

PACKAGE PERTAINS TO: 146400-2

PACKAGE CONTENTS

QUANTITY	NAME OF ITEM	DWG NO.	PART NO.	NOTES
1	CONTROL UNIT ASSEMBLY	146402	146402-1	
1	LOADER UNIT ASSEMBLY	146407	146407-1	
1	KILL STATUS INDICATOR	271105	271105-2	
1	ULT/ADAPTER ASSY, 120MM CANNON	146405	146405-2	
1	POWER CONTROLLER ASSY	146409	146409-2	
1	CABLE VIS ASSY, IN TL/EXT M1A1/A2	146508	146508-1	
1	DETECTOR BELT ASSY, L-REAR M1A1/A2	146440	146440-1	
1	DETECTOR BELT ASSY, R-FR M1A1/A2	146442	146442-1	
1	OPTICAL TURRET POSNG DEVICE ASSY	146408	146408-1	
1	MAST ASSY, KSI	146403	146403-1	
1	CABLE ASSY, COAX MICROPHONE	146430	146430-1	
1	SAT ASSY, M 2, M1A1	147571	147571-6	
1	SAT ASSY, M 240	148460	148460-2	
4	DETECTOR ASSEMBLY, TORSO	148245	148245-1	
4	DETECTOR ASSEMBLY, HELMET	148246	148246-1	
8	WEDGE ASSY, DETECTOR BELTS	146435	146435-1	
1	TRANSIT CASE, M1A1	146425	146425-1	4
AR	OPERATOR'S MANUAL		TD 9-6920-720	
1	GROMMET, PERISCOPE SEAL	146509	146509-8	
4	STRAP, BLK, 3/4" X 6"			1
4	STRAP, BLK, 3/4" X 8"			2
2	STRAP, BLK, 3/4" X 12"			3

NOTES:

1. MAY BE PURCHASED IN BULK QUANTITY AS PART OF VELCRO USA, CAGE CODE 11153, PART NO. 170790. THIS REEL CONSISTS OF 1200 STRAPS.
2. MAY BE PURCHASED IN BULK QUANTITY AS PART OF VELCRO USA, CAGE CODE 11153, PART NO. 170091. THIS REEL CONSISTS OF 900 STRAPS.
3. MAY BE PURCHASED IN BULK QUANTITY AS PART OF VELCRO USA, CAGE CODE 11153, PART NO. 170782. THIS REEL CONSISTS OF 600 STRAPS.
4. MARK THE TRANSIT CASE (2 PLACES) WITH THE APPLICABLE DASH NO. AFTER THE BASIC PART NUMBER. THE MARKING SHALL BE 6.35mm HIGH CHARACTERS MINIMUM, COLOR WHITE NO. 27925 IN ACCORDANCE WITH FED-STD-595 LOCATE AS SHOWN ON TRANSIT CASE DRAWING.

Table 1-5. Kit/Equipment List - Continued.

PACKAGE NOMENCLATURE: SIMULATION SYSTEM, COMBAT VEHICLE SYSTEM, M1A1/M1A2 TANK,VIC COMM SYSTEM

PACKAGE PERTAINS TO: 146501-1

PACKAGE CONTENTS

QUANTITY	NAME OF ITEM	DWG NO.	PART NO.	NOTES
1	CONTROL UNIT ASSEMBLY	146402	146402-1	
1	LOADER UNIT ASSEMBLY	146407	146407-1	
1	KILL STATUS INDICATOR	271105	271105-1	
1	ULT/ADAPTER ASSY, 120MM CANNON	146405	146405-1	
1	POWER CONTROLLER ASSY	146409	146409-1	
1	CABLE ASSY, INTERNAL/EXTERNAL M1A1/M1A2	146460	146460-1	
1	DETECTOR BELT ASSY, L-REAR M1A1/M1A2	146440	146440-1	
1	DETECTOR BELT ASSY, R-FR M1A1/M1A2	146442	146442-1	
1	OPTICAL TURRET POSITIONING DEVICE ASSY	146408	146408-1	
1	MAST ASSY, KSI	146403	146403-1	
1	CABLE ASSY, COAX MICROPHONE	146430	146430-1	
1	SAT ASSY, M 2	147571	147571-1	
1	SAT ASSY, M 2, M1A1	147571	147571-2	
1	SAT ASSY, M 240	147576	147576-2	
4	DETECTOR ASSEMBLY, TORSO	147421	147421-1	
4	DETECTOR ASSEMBLY, HELMET	147422	147422-1	
8	WEDGE ASSY, DETECTOR BELTS	146435	146435-1	
1	TRANSIT CASE, M1A1/M1A2	146425	146425-3	4
1	GROMMET, PERISCOPE SEAL	146509	146509-8	
4	STRAP, BLK, 3/4" X 6"			1
4	STRAP, BLK, 3/4" X 8"			2
2	STRAP, BLK, 3/4" X 12"			3
AR	OPERATOR'S MANUAL		TD 9-6920-720	

NOTES:

1. MAY BE PURCHASED IN BULK QUANTITY AS PART OF VELCRO USA, CAGE CODE 11153, PART NO. 170790. THIS REEL CONSISTS OF 1200 STRAPS.
2. MAY BE PURCHASED IN BULK QUANTITY AS PART OF VELCRO USA, CAGE CODE 11153, PART NO. 170091. THIS REEL CONSISTS OF 900 STRAPS.
3. MAY BE PURCHASED IN BULK QUANTITY AS PART OF VELCRO USA, CAGE CODE 11153, PART NO. 170782. THIS REEL CONSISTS OF 600 STRAPS.
4. MARK THE TRANSIT CASE (2 PLACES) WITH THE APPLICABLE DASH NO. AFTER THE BASIC PART NUMBER. THE MARKING SHALL BE 6.35mm HIGH CHARACTERS MINIMUM, COLOR WHITE NO. 27925 IN ACCORDANCE WITH FED-STD-595, LOCATE AS SHOWN ON TRANSIT CASE DRAWING.

Table 1-5. Kit/Equipment List - Continued.

PACKAGE NOMENCLATURE: SIMULATION SYSTEM, COMBAT VEHICLE SYSTEM, M1A1/M1A2 TANK, VIS COMM SYSTEM

PACKAGE PERTAINS TO: 146501-2

PACKAGE CONTENTS

QUANTITY	NAME OF ITEM	DWG NO.	PART NO.	NOTES
1	CONTROL UNIT ASSEMBLY	146402	146402-1	
1	LOADER UNIT ASSEMBLY	146407	146407-1	
1	KILL STATUS INDICATOR	271105	271105-2	
1	ULT/ADAPTER ASSY, 120MM CANNON	146405	146405-2	
1	POWER CONTROLLER ASSY	146409	146409-1	
1	CABLE ASSY, INTL/EXT M1A1/M1A2, VIS	146508	146508-1	
1	DETECTOR BELT ASSY, L-REAR M1A1/M1A2	146440	146440-1	
1	DETECTOR BELT ASSY, R-FR M1A1/M1A2	146442	146442-1	
1	OPTICAL TURRET POSITIONING DEVICE ASSY	146408	146408-1	
1	MAST ASSY, KSI	146403	146403-1	
1	CABLE ASSY, COAX MICROPHONE	146430	146430-1	
1	SAT ASSY, M 2	147571	147571-3	
1	SAT ASSY, M 2, M1A1	147571	147571-4	
1	SAT ASSY, M 240	147576	147576-4	
4	DETECTOR ASSEMBLY, TORSO	147421	147421-2	
4	DETECTOR ASSEMBLY, HELMET	147422	147422-2	
8	WEDGE ASSY, DETECTOR BELTS	146435	146435-1	
1	TRANSIT CASE, M1A1/M1A2	146425	146425-3	4
1	GROMMET, PERISCOPE SEAL	146509	146509-8	
4	STRAP, BLK, 3/4" X 6"			1
4	STRAP, BLK, 3/4" X 8"			2
2	STRAP, BLK, 3/4" X 12"			3
AR	OPERATOR'S MANUAL		TD 9-6920-720	

NOTES:

1. MAY BE PURCHASED IN BULK QUANTITY AS PART OF VELCRO USA, CAGE CODE 11153, PART NO. 170790. THIS REEL CONSISTS OF 1200 STRAPS.
2. MAY BE PURCHASED IN BULK QUANTITY AS PART OF VELCRO USA, CAGE CODE 11153, PART NO. 170091. THIS REEL CONSISTS OF 900 STRAPS.
3. MAY BE PURCHASED IN BULK QUANTITY AS PART OF VELCRO USA, CAGE CODE 11153, PART NO. 170782. THIS REEL CONSISTS OF 600 STRAPS.
4. MARK THE TRANSIT CASE (2 PLACES) WITH THE APPLICABLE DASH NO. AFTER THE BASIC PART NUMBER. THE MARKING SHALL BE 6.35mm HIGH CHARACTERS MINIMUM, COLOR WHITE NO. 27925 IN ACCORDANCE WITH FED-STD-595, LOCATE AS SHOWN ON TRANSIT CASE DRAWING.

See Figures 1-2 and 1-3 located at the end of this table.

Table 1-5. Kit/Equipment List - Continued.

PACKAGE NOMENCLATURE: SIMULATION SYSTEM, COMBAT VEHICLE SYSTEM, M1A1/M1A2 TANK, VIS COMM SYSTEM				
PACKAGE PERTAINS TO: 146501-3				
PACKAGE CONTENTS				
QUANTITY	NAME OF ITEM	DWG NO.	PART NO.	NOTES
1	CONTROL UNIT ASSEMBLY	146402	146402-1	
1	LOADER UNIT ASSEMBLY	146407	146407-1	
1	KILL STATUS INDICATOR	271105	271105-2	
1	ULT/ADAPTER ASSY, 120MM CANNON	146405	146405-2	
1	POWER CONTROLLER ASSY	146409	146409-2	
1	CABLE ASSY, INTL/EXT M1A1/M1A2, VIS	146508	146508-1	
1	DETECTOR BELT ASSY, L-REAR M1A1/M1A2	146440	146440-1	
1	DETECTOR BELT ASSY, R-FR M1A1/M1A2	146442	146442-1	
1	OPTICAL TURRET POSITIONING DEVICE ASSY	146408	146408-1	
1	MAST ASSY, KSI	146403	146403-1	
1	CABLE ASSY, COAX MICROPHONE	146430	146430-1	
1	SAT ASSY, M 2	147571	147571-5	
1	SAT ASSY, M 2, M1A1	147571	147571-6	
1	SAT ASSY, M 240	148460	148460-2	
4	DETECTOR ASSEMBLY, TORSO	148245	148245-1	
4	DETECTOR ASSEMBLY, HELMET	148246	148246-1	
8	WEDGE ASSY, DETECTOR BELTS	146435	146435-1	
1	TRANSIT CASE, M1A1/M1A2	146425	146425-3	4
1	GROMMET, PERISCOPE SEAL	146509	146509-8	
4	STRAP, BLK, 3/4" X 6"			1
4	STRAP, BLK, 3/4" X 8"			2
2	STRAP, BLK, 3/4" X 12"			3
AR	OPERATOR'S MANUAL		TD 9-6920-720	

NOTES:

1. MAY BE PURCHASED IN BULK QUANTITY AS PART OF VELCRO USA, CAGE CODE 11153, PART NO. 170790. THIS REEL CONSISTS OF 1200 STRAPS.
2. MAY BE PURCHASED IN BULK QUANTITY AS PART OF VELCRO USA, CAGE CODE 11153, PART NO. 170091. THIS REEL CONSISTS OF 900 STRAPS.
3. MAY BE PURCHASED IN BULK QUANTITY AS PART OF VELCRO USA, CAGE CODE 11153, PART NO. 170782. THIS REEL CONSISTS OF 600 STRAPS.
4. MARK THE TRANSIT CASE (2 PLACES) WITH THE APPLICABLE DASH NO. AFTER THE BASIC PART NUMBER. THE MARKING SHALL BE 6.35mm HIGH CHARACTERS MINIMUM, COLOR WHITE NO. 27925 IN ACCORDANCE WITH FED-STD-595, LOCATE AS SHOWN ON TRANSIT CASE DRAWING.

See Figures 1-2 and 1-3 located at the end of this table.

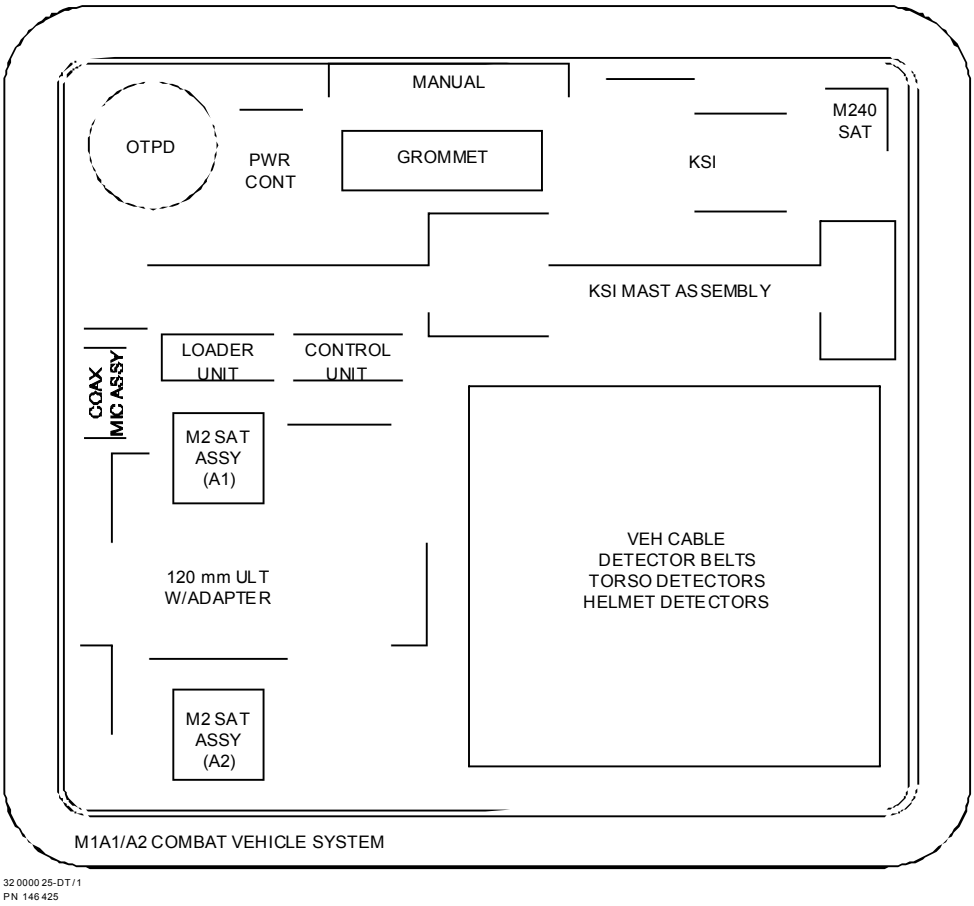


Figure 1-2. M1A1/A2 Combat Vehicle System Transit Case

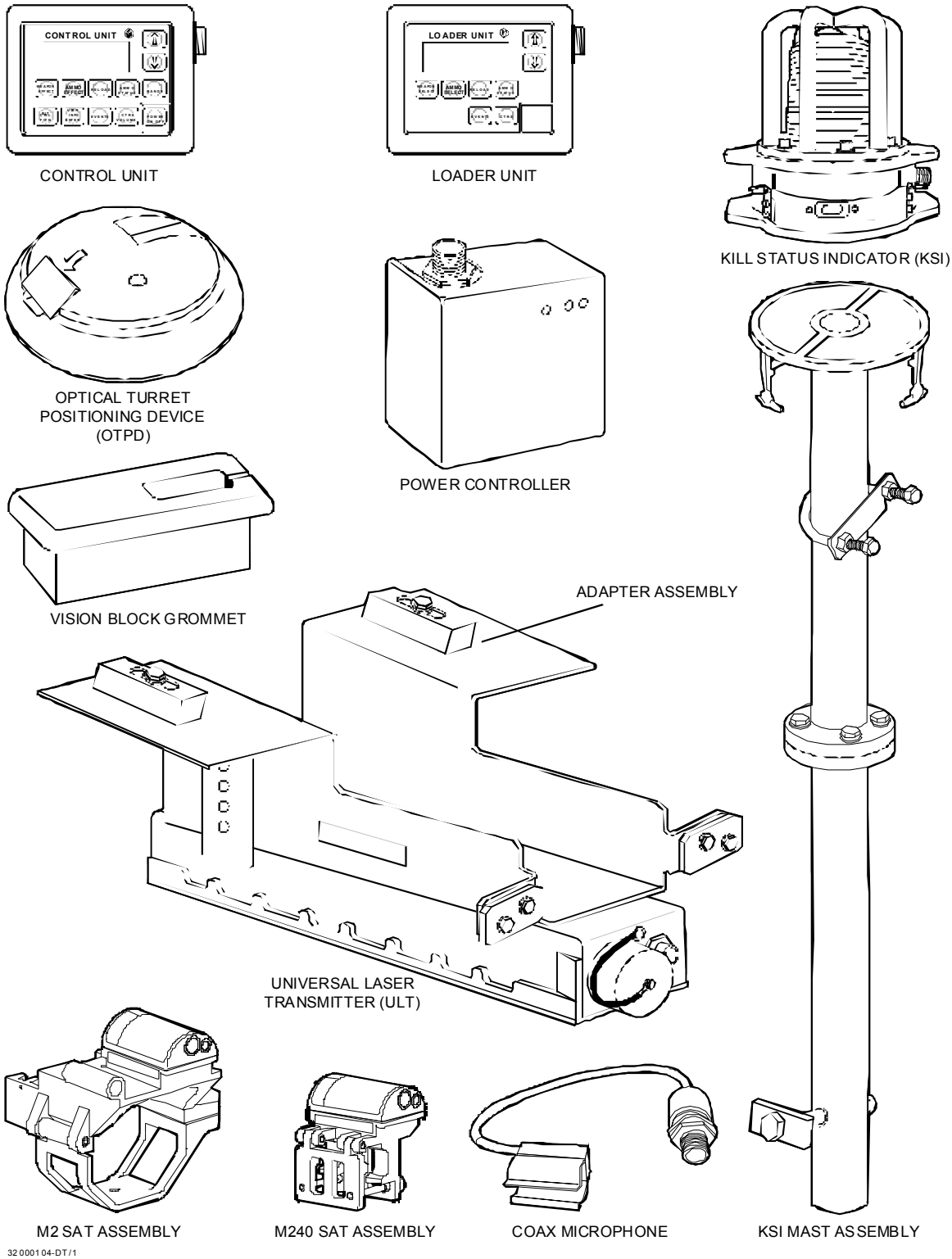
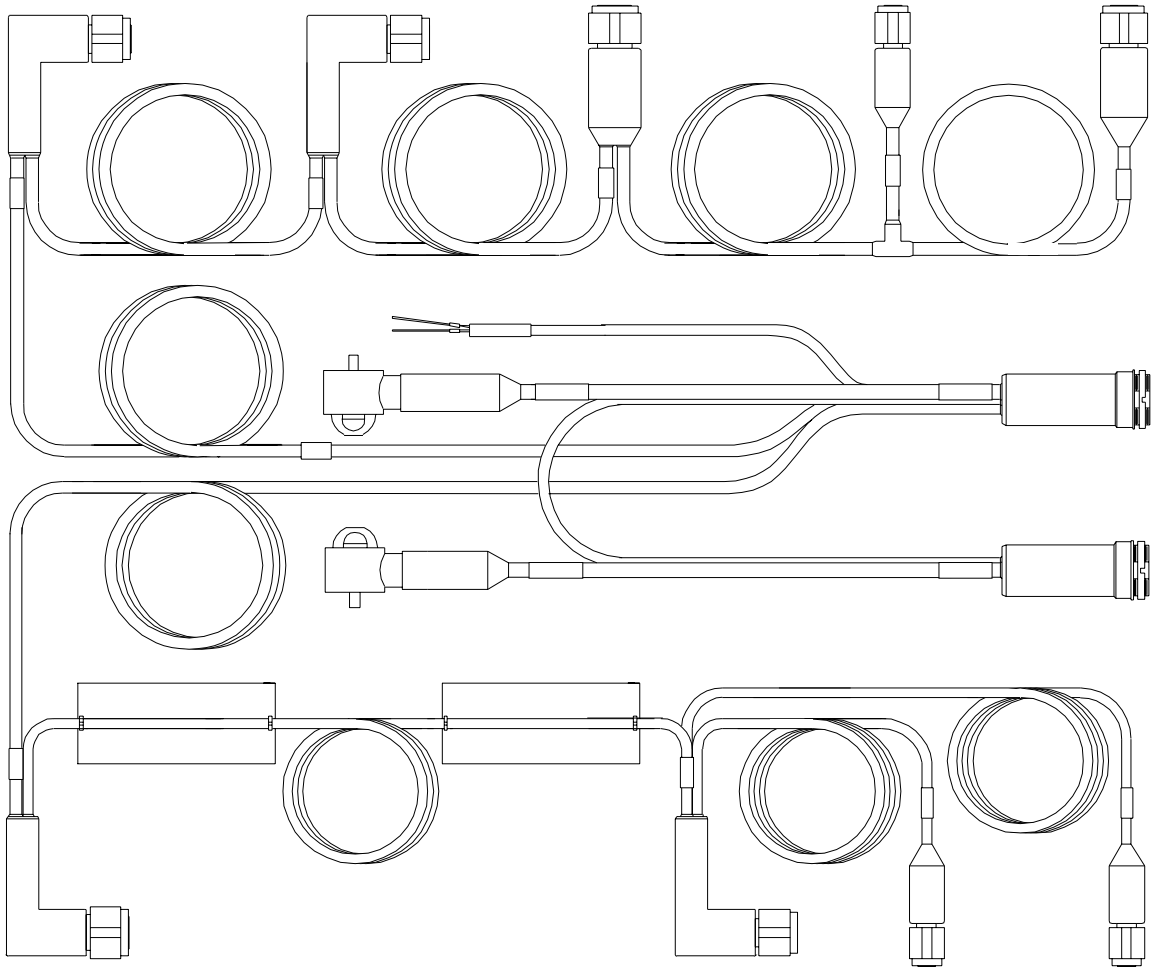
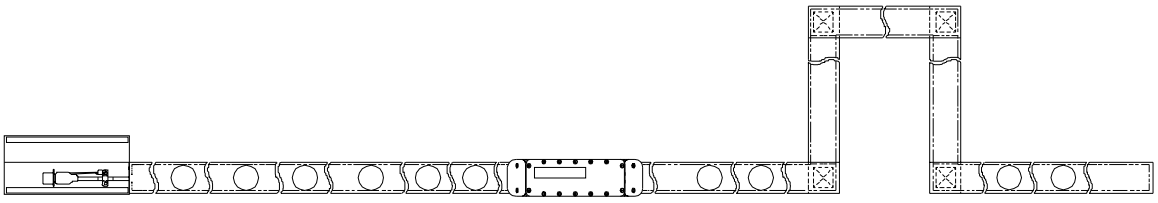


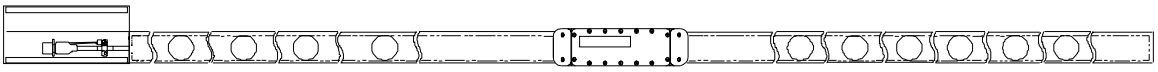
Figure 1-3. M1CVS System Components (Items not to Scale) Sheet 1 of 2)



M1A1 VIC SYSTEM CABLE



RIGHT-FRONT DETECTOR BELT



LEFT-REAR DETECTOR BELT

32000104A-DT

Figure 1-3. M1CVS System Components (Items not to Scale)(Sheet 2 of 2).

CHAPTER 2
OPERATING INSTRUCTIONS

SECTION I. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS

2.1 EQUIPMENT FIGURES AND TABLES.

The following figures, as listed in Table 2-1, illustrate and describe the MILES 2000 M1A1/M1A2 operating controls and indicators.

Table 2-1. Controls and Indicators Reference

ITEM	FIGURE NO.
Small Arms Transmitter (SAT)	2-1
Individual Weapons System (IWS) (PN 147421)	2-2
Individual Weapons System (IWS) (PN 148245)	2-3
Detector Belts	2-4
Kill Status Indicator (KSI)	2-5
Universal Laser Transmitter (ULT)	2-6
Control Unit (CU)	2-7
Power Controller	2-8
Loader Unit (LU) (M1A1/M1A2 only)	2-9
Optical Turret Positioning Device (OTPD)	2-10

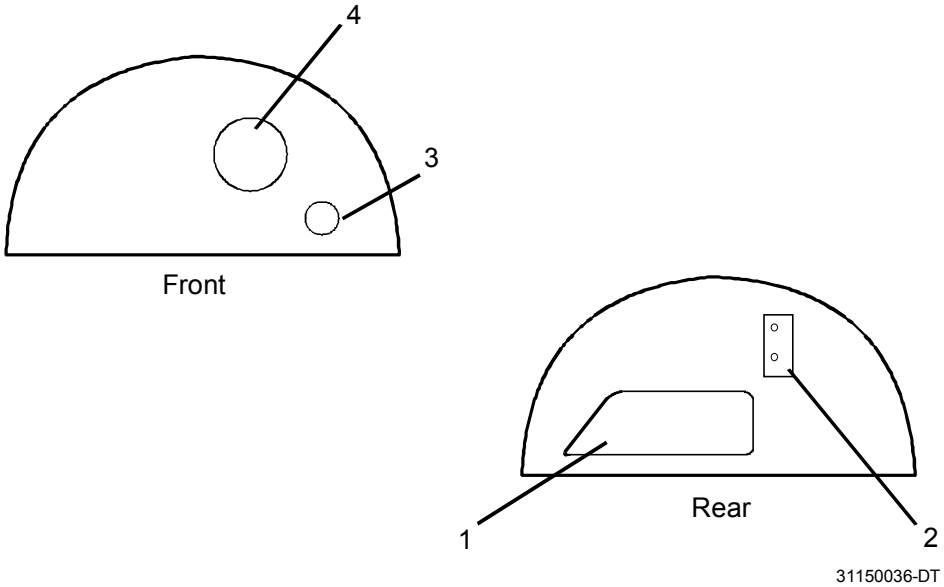


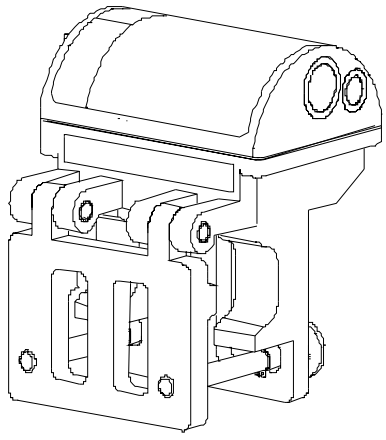
Figure 2-1. Small Arms Transmitter (SAT) (Sheet 1 of 3).

1. FIRING INDICATOR AND IR TRANSMITTER/RECEIVER PORT. Firing indicator illuminates when the SAT is fired as a visual aide to the soldier. IR Port provides a link between the weapon and the manworn.

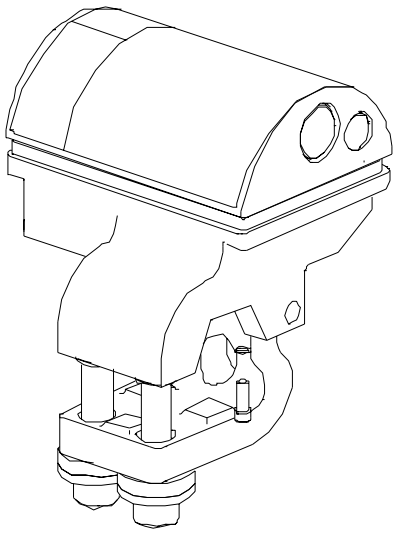
2. ALIGNMENT SHAFTS. Used to adjust the laser alignment with the Automatic Small Arms Alignment Fixture (ASAAF).

3. BLANK SENSOR WINDOW. Allows light flash from blank firing of the weapon to be sensed so the SAT laser will be transmitted.

4. LASER OPTICAL WINDOW. Window through which the SAT laser beam is transmitted.

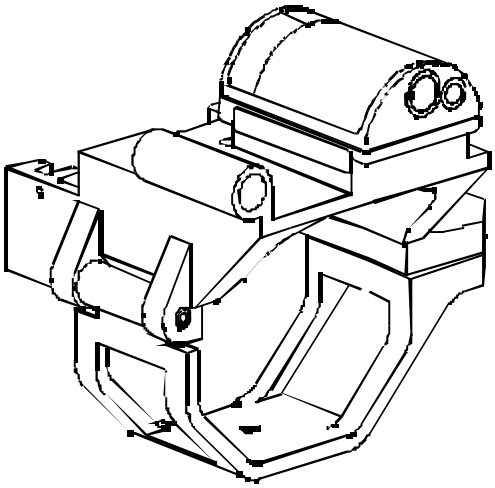


M240 SAT (Standard)
(PN 147576)



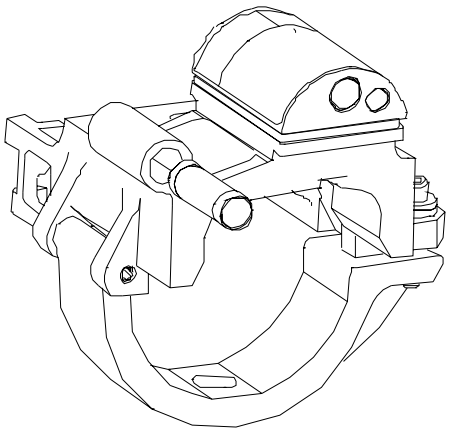
M240 SAT (Universal)
(PN 148460)

Figure 2-1. Small Arms Transmitter (SAT) (Sheet 2 of 3).



M2 SAT
(PN 147571-1 THRU -4)

32 0000 52-DT / 1



M2 SAT
(PN 147571-5 AND -6)

32 0001 03-DT / 1
14 7571 D2

Figure 2-1. Small Arms Transmitter (SAT) (Sheet 3 of 3).

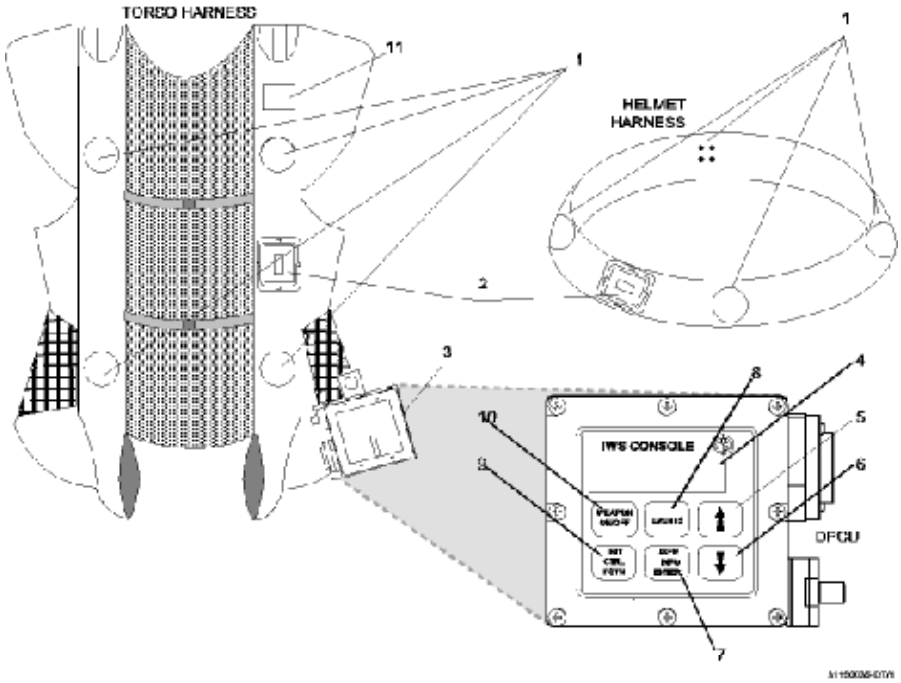


Figure 2-2. Individual Weapons System (IWS) (PN 147421).

1. DETECTORS. The laser detectors receive coded messages from incoming laser transmitters.

2. AMPLIFIER. Amplifies coded messages received from incoming laser transmitters and forwards them to the IWS Console (DPCU) for decoding.

3. IWS CONSOLE [DATA PROCESSING CONTROL UNIT (DPCU)]. Data processing unit for the IWS. Provides user interface and decodes the laser and IR transmitted data for the IWS. Powered by 9-volt battery with approximately 72-hours battery life.

4. DISPLAY WINDOW. Displays system messages.

5. SCROLL UP PUSH BUTTON. Scrolls display up when pressed.

6. SCROLL DOWN PUSH BUTTON. Scrolls display down when pressed.

7. USER INFO/ENTER PUSH BUTTON. Displays user information on the display window and provides enter function for information input.

8. EVENTS PUSH BUTTON. Recalls up to the 16 most recent events when pushed.

9. BIT/CTRL FCTN PUSH BUTTON. Executes BIT and provides various control functions to the user.

10. WEAPON ON/OFF PUSH BUTTON. Enables/disables the Small Arms Transmitter (SAT) via an infrared (IR) link when pressed and IWS is not in a “killed” state.

11. INFRARED (IR) TRANSMITTER. IR communication link between the SAT and the IWS Console (DPCU), and the SAT and Torso and Helmet Harness detectors. Transmits PID and ENABLE/DISABLE to SAT.

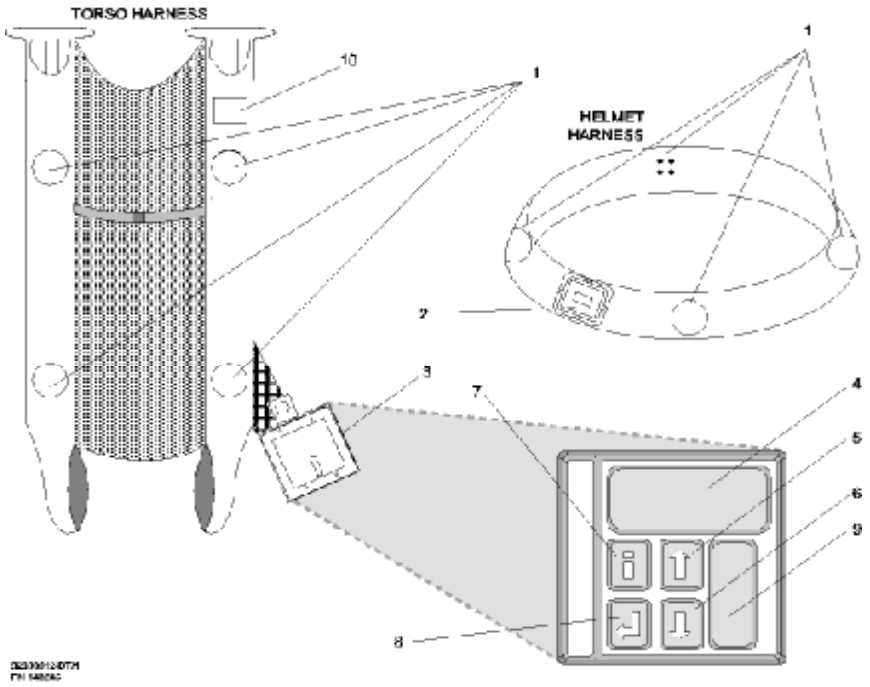


Figure 2-3. Individual Weapons System (IWS) (PN 148245).

1. DETECTORS. The laser detectors receive coded messages from incoming laser transmitters.

2. AMPLIFIER. Amplifies coded messages received from incoming laser transmitters and forwards them to the IWS Console (DPCU) for decoding.

3. IWS CONSOLE [DATA PROCESSING CONTROL UNIT (DPCU)]. Data processing unit for the IWS. Provides user interface and decodes the laser and IR transmitted data for the IWS. Powered by an internal 3.6-volt lithium battery with approximately a 12-month battery life.

4. DISPLAY WINDOW. Displays system messages.

5. SCROLL UP PUSH BUTTON. Scrolls display up when pressed.

6. SCROLL DOWN PUSH BUTTON. Scrolls display down when pressed.

7. INFO PUSH BUTTON. Displays user information on the display.

8. ENTER PUSH BUTTON. Provides Enter function for information input.

9. OPTICAL PORT. Bidirectional IR communication link used by CD/TDTD for uploading and downloading data.

10. INFRARED (IR) TRANSMITTER. IR communication link between the SAT and the IWS Console (DPCU), and the SAT and Torso Harness and Helmet Harness detectors. Transmits PID and ENABLE/DISABLE to SAT.

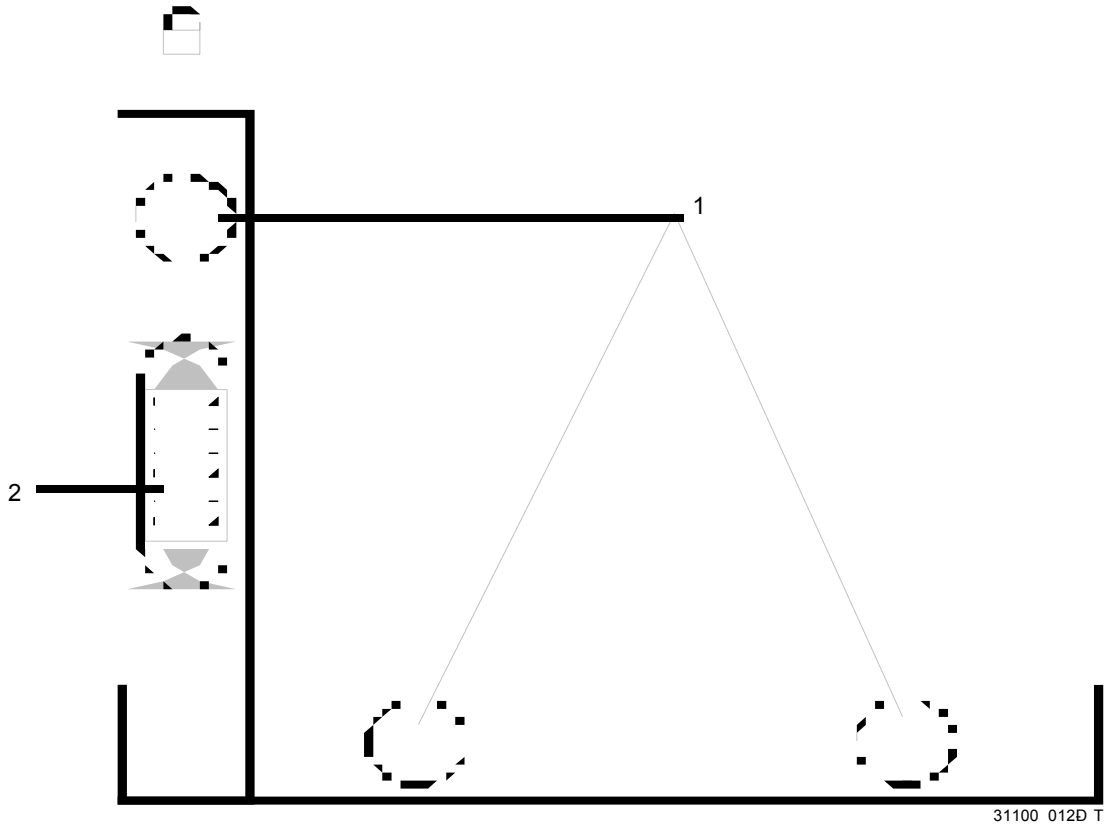


Figure 2-4. Vehicle Detector Belt Components.

1. DETECTORS. Detects laser transmissions that are being fired at the vehicle.

2. AMPLIFIER. Amplifies coded laser signals that simulate incoming fire and forwards them to the KSI.

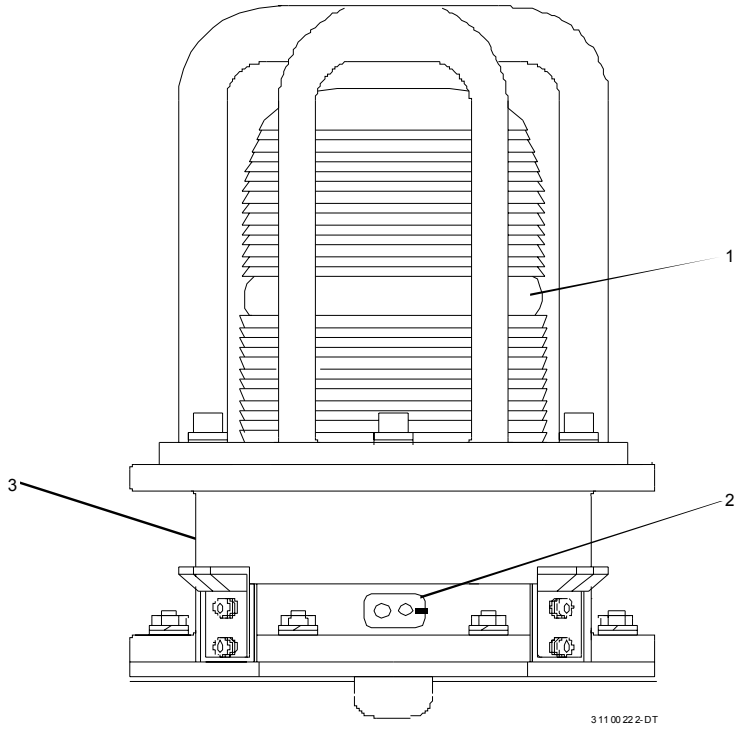


Figure 2-5. Kill Status Indicator (KSI) Assembly

1. VISUAL STROBE. Provides a 360° azimuth and 60° elevation optical output when a vehicle is hit (housed in an amber dome).

2. OPTICAL PORT. Bidirectional IR communication link used by CD/TDTD for uploading and downloading data.

3. CONNECTOR (not shown). System Cable connection.

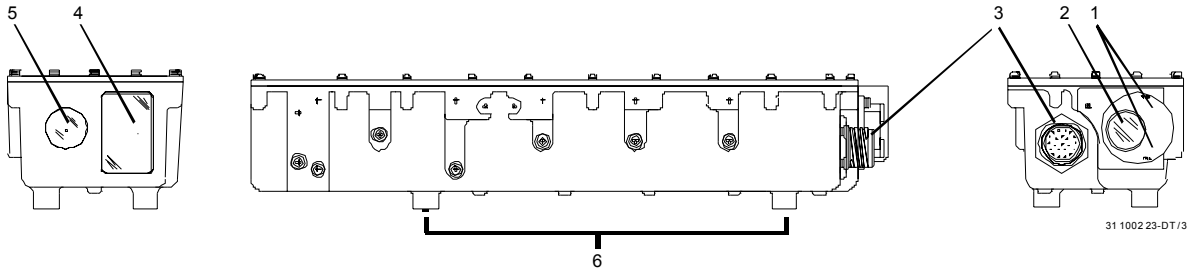


Figure 2-6. Universal Laser Transmitter (ULT).

1. BORESIGHT ADJUSTMENT KNOB. Used to align the ULT scope to the target.
2. SCOPE REAR SIGHT. Used to align the main gun with the target.
3. CONNECTOR. Cable connection from the CU to the ULT.
4. FLASHWESS. Indicates when the main gun has been fired (M2/M3).
5. LASER OPTICAL WINDOW. Window through which the ULT laser beam is transmitted.
6. ADAPTER MOUNTING POSTS. (Adapter mount not shown).

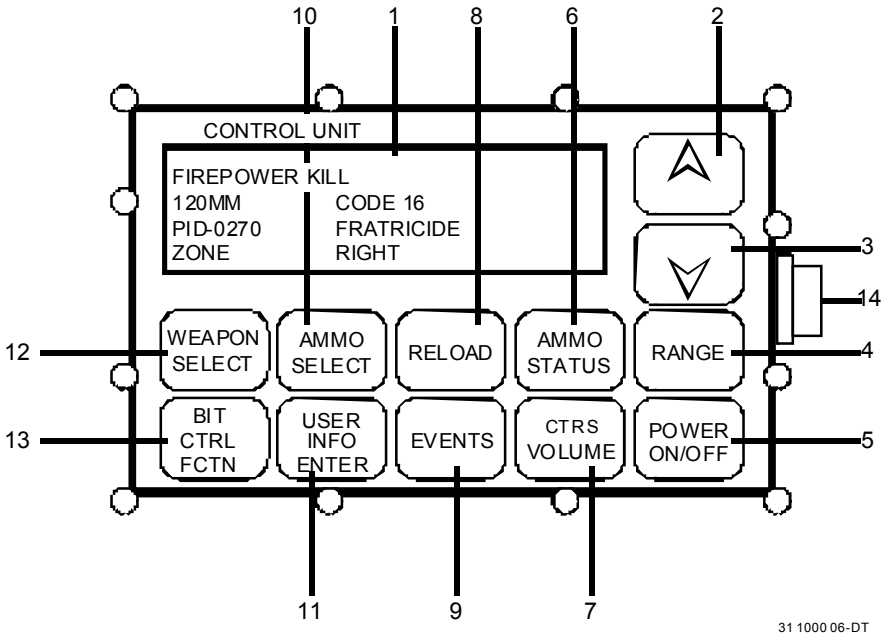


Figure 2-7. Control Unit (CU).

1. DISPLAY WINDOW. Displays events and system messages. (Example display shown.)

2. SCROLL UP PUSH BUTTON. Scrolls display up when pressed.

3. SCROLL DOWN PUSH BUTTON. Scrolls display down when pressed.

4. RANGE PUSH BUTTON. Allows the operator the option to input his estimate of target range (M2/M3 TOW ONLY).

5. POWER ON/OFF PUSH BUTTON. Enables/disables the MILES 2000 System.

6. AMMO STATUS PUSH BUTTON. Displays number of rounds remaining for selected weapon.

7. CTRS/VOLUME PUSH BUTTON. CTRS allows user to adjust illumination of display. VOLUME allows user to adjust audio to the vehicle headset.

8. RELOAD PUSH BUTTON. Causes the system to load any available selected remaining ammunition shown in the display window.

9. EVENTS PUSH BUTTON. Allows the operator to review the 16 most recent events on the display window.

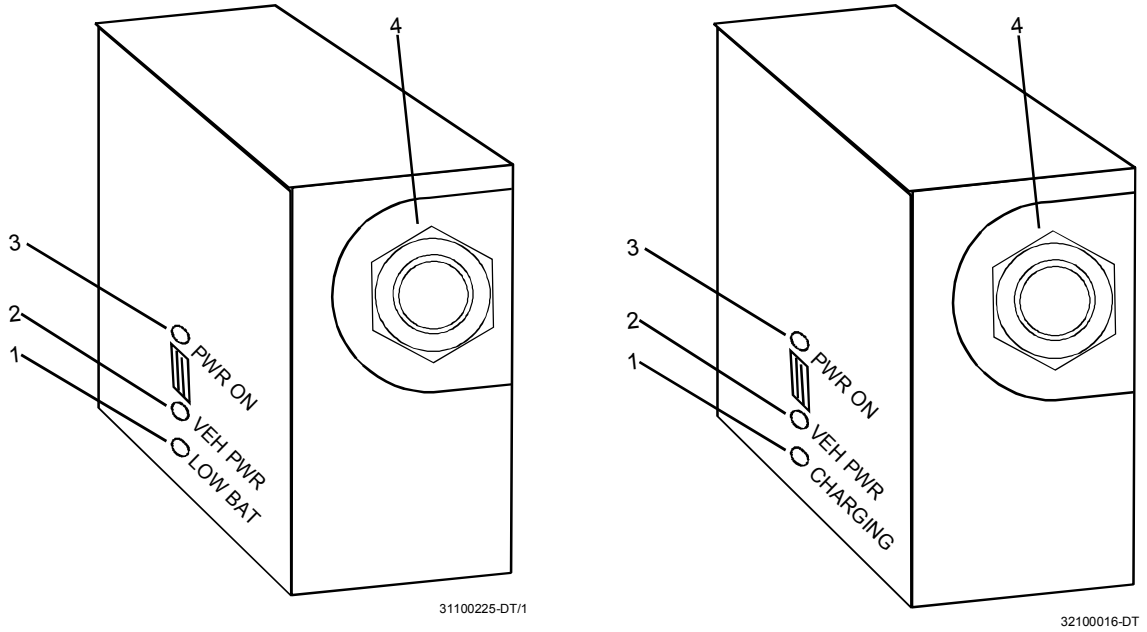
10. AMMO SELECT PUSH BUTTON. Allows the operator to view the different ammunition quantities and types available for a main gun (**M1A1 ONLY**) or TOW (**M2/M3 ONLY**).

11 . USER INFO/ENTER PUSH BUTTON. Allows operator the ability to check his PID and vehicle type, override the communications disable function under Communications/Catastrophic kill conditions in an emergency, and to enable/disable a DIFCUE or MGSS. ENTER allows controller to enter commands selected in Control Mode.

12. WEAPON SELECT PUSH BUTTON. Allows the operator the option to select the desired weapon to be used.

13. BIT/CTRL FCTN PUSH BUTTON. A BIT executes a system BIT with the results shown in the display window. CTRL FCTN allows controller to select vehicle platform type, blank or dry fire coax activation, FlashWESS or ATWESS activation, etc.

14. CONNECTOR. System Cable connection.



146409-1 146409-2

Figure 2-8. Power Controller.

1. LOW BATT INDICATOR (146409-1). LED blinks continuously to indicate low internal battery power. Illuminates when battery voltage drops to 21 ±1 Vdc.

2. CHARGING INDICATOR (146409-2). Illuminates when battery voltage drops below 27.5 Vdc, and battery is charging.

3. VEHICLE POWER PRESENT INDICATOR. LED blinks continuously when vehicle power is at the CVS system, and the internal batteries are being trickle charged.

4. 10.5 VDC POWER PRESENT INDICATOR. LED blinks continuously when 10.5 Vdc power is ON.

5. CONNECTOR. System Cable connection.

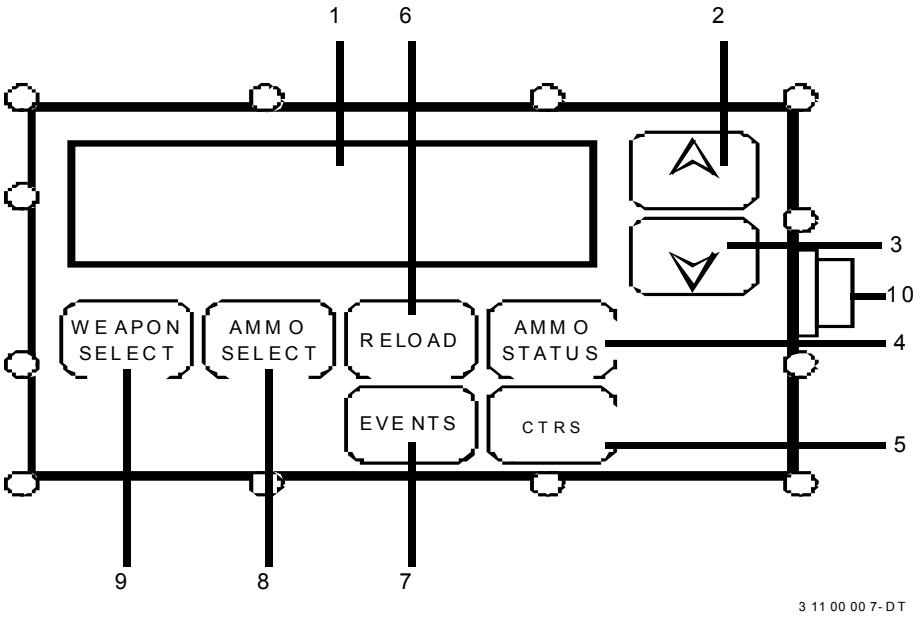


Figure 2-9. Loader Unit (LU).

1. DISPLAY WINDOW. Displays events and system messages.

2. SCROLL UP PUSH BUTTON. Scrolls display up when pressed.

3. SCROLL DOWN PUSH BUTTON. Scrolls display down when pressed.

4. AMMO STATUS PUSH BUTTON. Displays rounds remaining.

5. CTRS PUSH BUTTON. Allows user to adjust illumination of display.

6. RELOAD PUSH BUTTON. Causes the system to load any available selected remaining ammunition shown in the display window.

7. EVENTS PUSH BUTTON. Allows the operator to review the last 16 most recent events on the display window.

8. AMMO SELECT PUSH BUTTON. Allows the operator to view the different ammunition quantities and types available for a main gun.

9. WEAPON SELECT PUSH BUTTON. Allows the operator the option to select the desired weapon to be used.

10. CONNECTOR. System Cable connection.

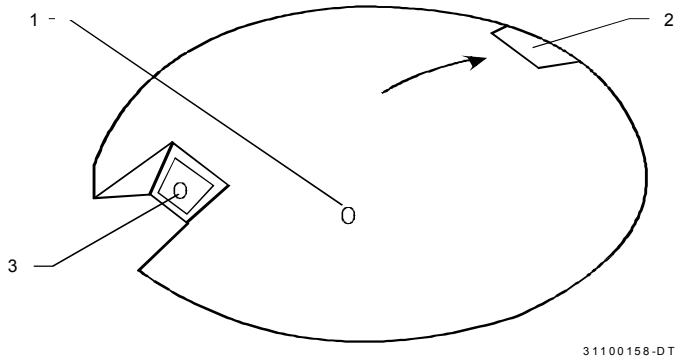


Figure 2-10. Optical Turret Position Device (OTPD).

1. POWER ON INDICATOR. Illuminates for six (6) seconds upon installation of a new 9-volt battery.

2. INFRARED TRANSMITTER WINDOW. Used by the OTPD to transmit an IR signal allowing the CVS System to determine the position of the turret when receiving an incoming MILES 2000 message

3. BATTERY DOOR SCREW. Turn counterclockwise to remove battery and clockwise to secure battery in battery compartment.

SECTION II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

Preventive Maintenance Checks and Services (PMCS) will ensure that the MILES 2000 equipment will be ready for operation and perform satisfactorily throughout its mission. Preventive maintenance checks consist of performing a systematic inspection to discover defects before they result in operational failure of the equipment. Defects or malfunctions discovered by the crew during use of the MILES 2000 equipment, or as a result of performing maintenance checks and services, will be reported using the proper forms.

2.2 INTRODUCTION TO PMCS TABLE

Operator Preventive Maintenance Checks and Services are shown in Table 2-2. Tasks to be performed before operation are checked in the "B" column under the heading "Interval;" tasks to be performed during operation are checked in the "D" column; tasks to be performed after operation are checked in the "A" column; tasks to be performed weekly are checked in the "W" column, and tasks to be performed monthly are checked in the "M" column. If there are no check marks in the weekly or monthly column, perform tasks daily.

NOTE

Within designated intervals, these checks are to be performed in the order listed.

B - Before Operation
D - During Operation
A - After Operation
W - Weekly
M - Monthly

Table 2-2. Operator Preventive Maintenance Checks and Services.

ITEM NO.	ITEM TO BE INSPECTED	INTERVAL B	D	A	W	M	PROCEDURES CHECK FOR AND HAVE REPAIRED	EQUIPMENT IS NOT READY/AVAILABLE IF:
1.	Individual Weapons Systems (IWS) Console (DPCU	✓		✓			Insect for cracks in display window and membrane switches.	Display window or membrane switch broken or cracked.
		✓	✓	✓			Check for display in display window when battery installed.	No display in display window.
		✓					Check for battery in unit (if applicable).	Battery not present (if applicable).
2.	IWS	✓		✓			Wipe all detectors clean. Inspect harness for damage that would prevent normal operation.	Detectors broken or missing. Amplifier cracked, broken, or missing.
3.	Small Arms Transmitter (SAT)	✓	✓	✓			Inspect for dirty or damaged window. Clean window.	Window broken, cracked, or missing.
4.	Control Unit (CU)	✓		✓			Inspect for cracks in display window and membrane switches.	Display window or membrane switch broken.
		✓	✓				Check for display in display window when powered on.	No display in display window when powered on.
5.	Kill Status Indicator (KSI)	✓		✓			Inspect for cracks in amber dome plastic lens of visual strobe.	Amber dome plastic lens cracked.
		✓		✓			Check for optical port damage.	Lens broken, cracked or missing.
6.	Coax Microphone	✓		✓			Inspect microphone for obvious damage. Make sure clip is securely attached.	Cracked or broken casing. Clip loose or missing.
		✓	✓				Wipe connector clean and inspect for damage.	Broken connector. Bent or missing pins.

Table 2-2. Operator Preventive Maintenance Checks and Services - Continued.

ITEM NO.	ITEM TO BE INSPECTED	INTERVAL B	D	A	W	M	PROCEDURES CHECK FOR AND HAVE REPAIRED	EQUIPMENT IS NOT READY/AVAILABLE IF:
6.	Coax Microphone (Continued)	✓		✓			Inspect cord for damage.	Broken or bare wires are broken.
7.	Universal Laser Transmitter (ULT)	✓		✓			Inspect for dirty or damaged lens.	Lens broken or cracked.
		✓	✓	✓			Make sure boresight knobs are securely attached to shafts.	Knobs broken or missing.
							Inspect connector for dirty or bent pins.	Pins dirty, bent or missing.
8.	Loader Unit (LU)	✓		✓			Inspect for cracks in display window and membrane switches.	Display window or membrane switch broken.
		✓	✓				Check for display in display window when powered on.	No display in display window when powered on.
9.	Optical Turret Positioning Device (OTPD)	✓					Check for battery in unit.	Battery not present.
		✓		✓			Inspect for cracks in plastic lens.	Lens cracked.
10.	Power Controller	✓		✓			Inspect for damaged connector.	Broken connector. Bent or missing pins.
		✓		✓			Inspect for acid leaks.	Acid is present.
11.	Detector Belts	✓		✓			Wipe all detectors/connectors clean. Inspect harnesses for damage that would prevent normal operation.	Detectors broken or missing. Connector pins dirty, bent, or missing. Amplifier broken.
12.	Cable and Connector Assemblies	✓		✓			Inspect for broken or bare wires.	Broken or bare wires are present.
		✓		✓			Inspect connectors for damage or broken pins.	Broken connectors. Bent or missing pins.

SECTION III. OPERATION UNDER USUAL CONDITIONS

2.3 ASSEMBLY AND PREPARATION FOR USE

MILES 2000 equipment must be inspected and prepared as described in the following paragraphs prior to use.

NOTE

When applying fastener tape, always apply the "hook" type tape to the holding surface (the surface to which an item will be installed) and the "pile" type tape to the item being installed. For example, when installing the Control Unit (CU) in the M1A1/M1A2, you would apply the hook tape to the side wall of the commander's station, and the loop tape to the CU. The CU pile tape can then be attached to the side wall hook tape, firmly securing the CU.

2.3.1 Individual Weapons System (IWS. The Individual Weapons System consists of the Torso Harness with IWS Console (DPCU) and the Helmet Harness.

2.3.1.1 Helmet Harness

2.3.1.1.1 Helmet Harness Installation for CVC Helmet. (See Figure 2-11.)

a. Remove the Helmet Harness from the Transit Case and inspect the harness for damage.

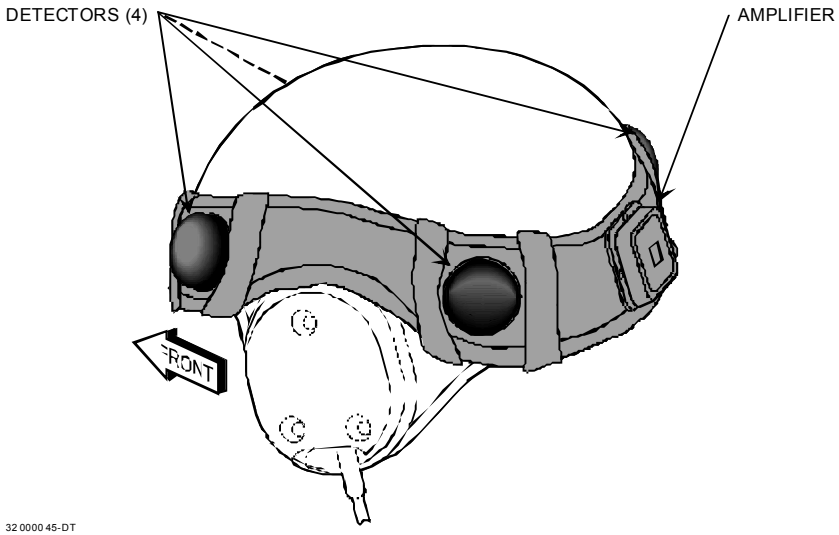


Figure 2-11. Helmet Harness (CVC

b. The Helmet Harness consists of a wide elasticized band with detectors, an amplifier, and three (3) patches of fastener tape.

c. Replace and report damaged equipment as required.

d. Wipe all detectors clean. Slip the Helmet Harness over the helmet with the amplifier to the rear of the helmet. Smooth out any wrinkles or twists. Ensure the harness fits snugly just above the helmet brim.

e. Mark the helmet where the fastener tape patches touch the helmet. Remove the harness.

WARNING

Tape primer is toxic and highly flammable. Do not spray near heat, open flame, or sparks. Use primer only in well ventilated areas. Do not permit smoking in the area. Injury to personnel may result.

f. Spray tape primer over the marked areas where the fastener tape will be attached. Let primer dry thoroughly (follow directions on the primer can) before applying tape.

g. Cut three (3) strips of fastener tape approximately two (2) inches long. Remove the backing paper and press the tape patches firmly onto the helmet where the primer was applied.

h. Put the Helmet Harness around the helmet.

i. Adjust the harness so the three (3) patches of fastener tape line up with the three (3) pieces on the helmet (ensure that there are no wrinkles or twists in the harness). Press the tape on the harness firmly against the tape on the helmet.

2.3.1.2 Torso Harness (See Figure 2-12.)

a. Remove the Torso Harness from the transit case and inspect for damage.

b. Replace and report damaged equipment as required.

c. Wipe all detectors and the IWS Console (DPCU) clean.

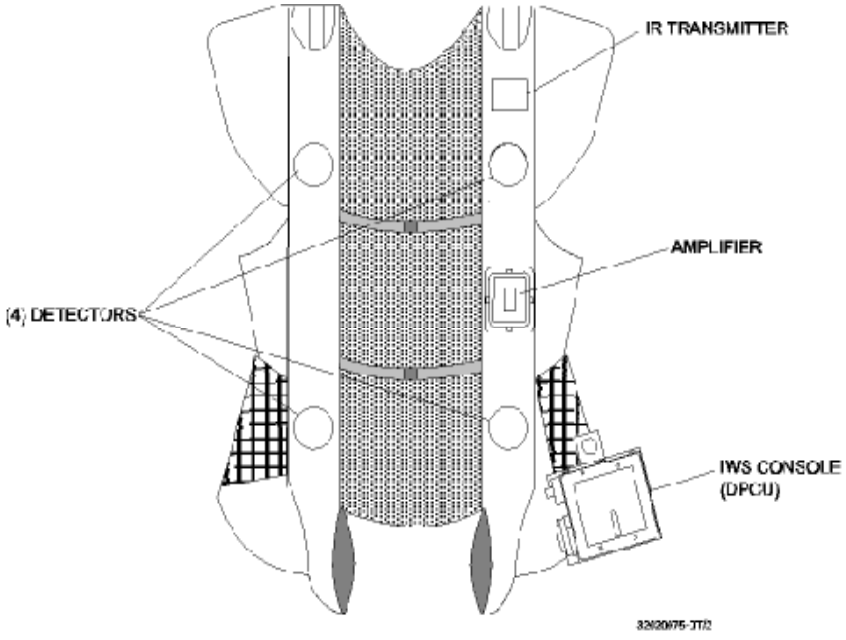


Figure 2-12. Torso Harness.

d. For PN 147421, put vest on and fasten two (2) vest clips. (See Figure 2-13A.)

e. For PN 147421, install the battery in the IWS Console (DPCU), loosen the thumbscrew and open the battery door. Install a 9-volt battery and secure the battery door using the thumbscrew.

CAUTION

Ensure battery door is securely closed during storage and operations, or damage can occur to the battery door.

f. For PN 148245, as you raise the harness, make sure the IWS Console (DPCU) is in the front. Then lower it over your head and fasten the vest clip. (See Figure 2-13B.)

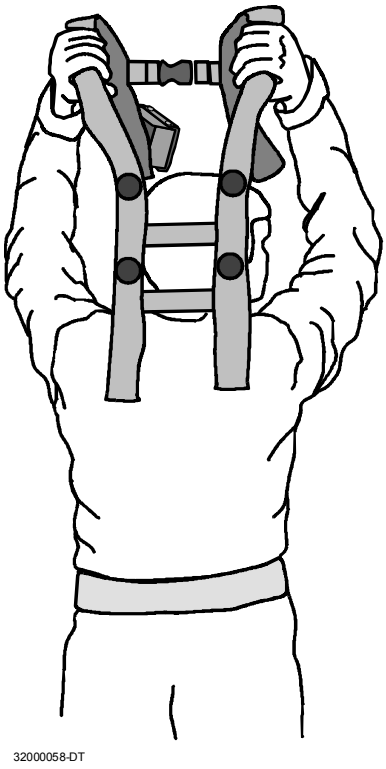


Figure 2-13. Torso Harness Installation M1A1/M1A2

2.3.2 Installation of MILES 2000 on M1A1/M1A2.

NOTE

Installation instructions for the Direct/Indirect Fire Cue (DIFCUE) are contained in TD 9-6920-893-10; installation instructions for the Main Gun Signature Simulator (MGSS) are contained in TD 9-6920-892-10.

Some vehicles may already have fastener tape applied. If so, proceed to installation instructions. Do not prime areas where there is already fastener tape in good condition.

2.3.2.1 M240 Small Arms Transmitter (SAT.

a. Remove the SAT from the transit case. The SAT and clamp are (1) one unit. Make sure the SAT is clean and dry, and not cracked or broken.

b. Inspect the Blank Sensor Window and the Laser Optical Window, making sure that they are not cracked, broken, or missing. Make sure the mounting clamp is operational.

c. Inspect the IR Transmit/Receive Window making sure that it is not cracked, broken, or missing.

d. Replace and report damaged equipment as required.

e. Attach the SAT to the barrel of the M240 and tighten the SAT socket head capscrews equally until finger tight. (See Figure 2-14.)

CAUTION

Use care when starting capscrews not to cross threads. **DO NOT** use any tools to tighten capscrews at this time.

Torque to 60 inch-pounds using the wrench supplied in the Automatic Small Arms Alignment Fixture (ASAAF) kit.

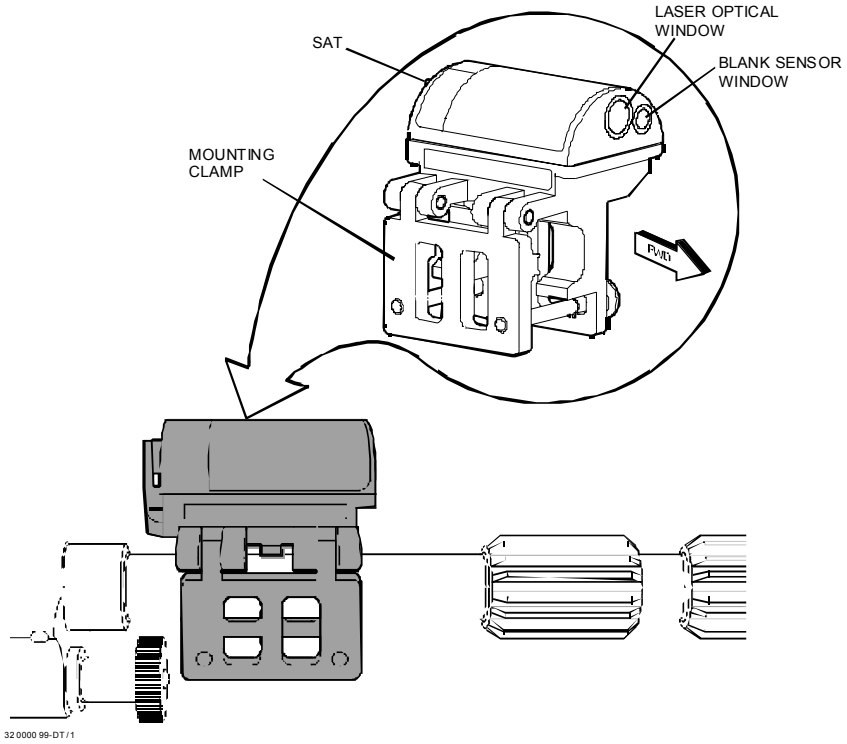


Figure 2-14. M240 SAT.

2.3.2.2 M2 Small Arms Transmitter (SAT).

a. Remove the SAT from the transit case. The SAT and clamp are one (1) unit. Make sure the SAT is clean and dry, and not cracked or broken.

b. Inspect the Blank Sensor Window and the Laser Optical Window, making sure that they are not cracked, broken, or missing. Make sure the mounting clamp is operational.

c. Inspect the IR Transmit/Receive Window making sure that it is not cracked, broken, or missing.

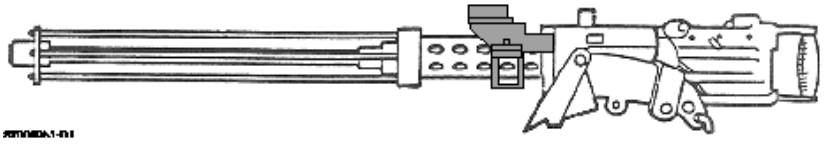
d. Replace and report damaged equipment as required.

e. Attach the SAT to the barrel of the M2 and tighten the SAT socket head capscrews equally until finger tight. (See Figure 2-15).

CAUTION

Use care when starting capscrews not to cross threads. **DO NOT** use any tools to tighten capscrews at this time.

f. Torque to 85 inch-pounds using the torque wrench supplied in the Automatic Small Arms Alignment Fixture (ASAAF) kit



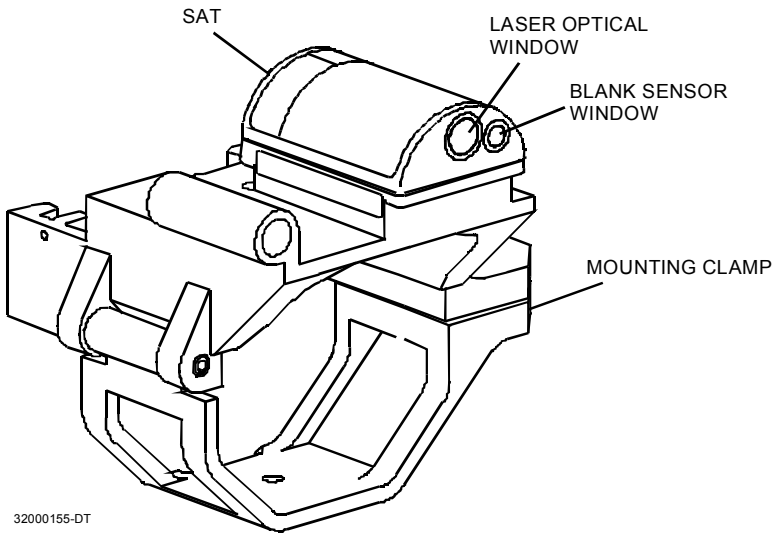


Figure 2-15. M2 Small Arms Transmitter (SAT).

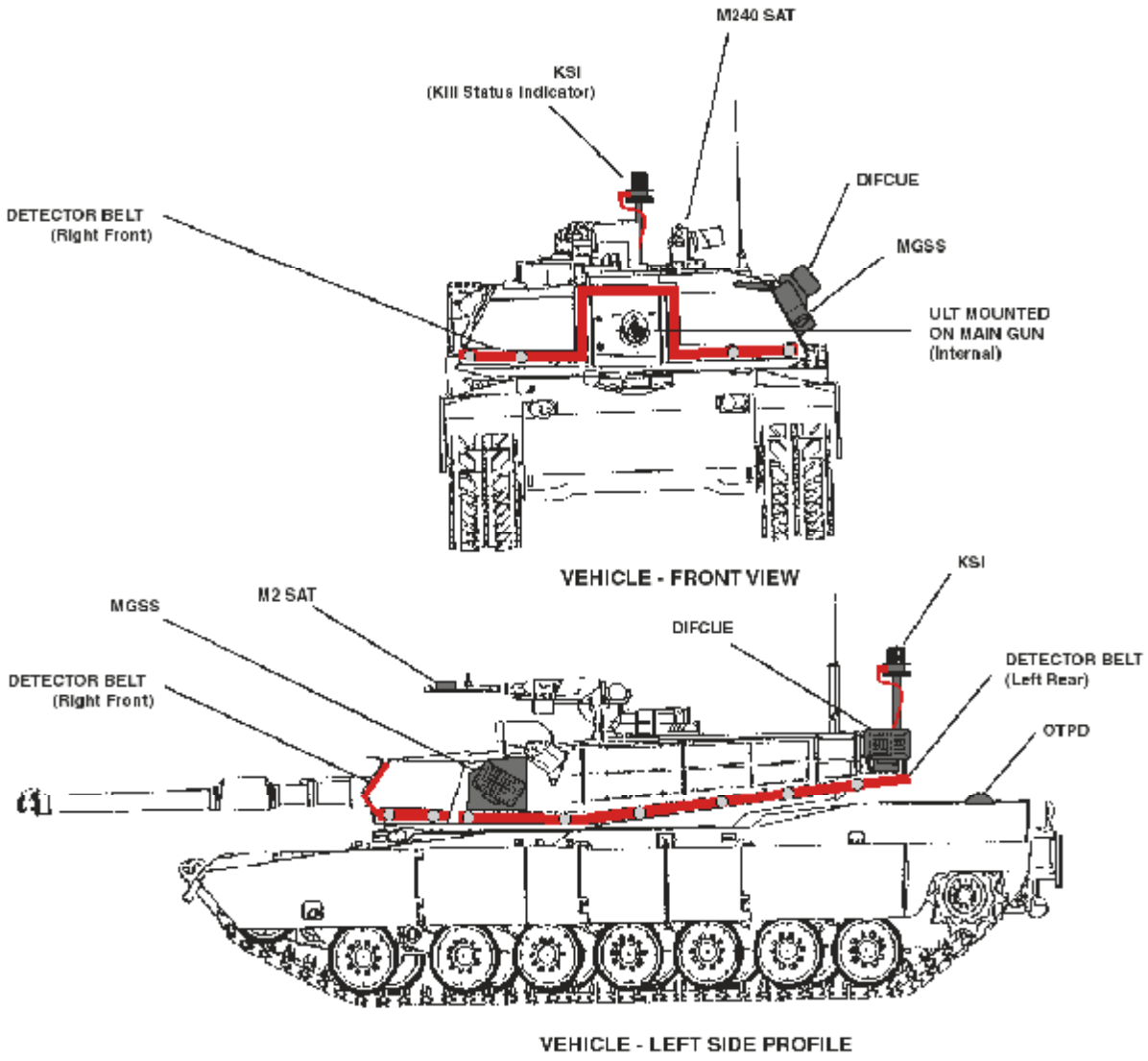


Figure 2-16. M1A1 Abrams Tank Detector Belt

2.3.2.3 Detector Belt Fastener Tape. (See Figure 2-16.)

2.3.2.3.1 Applying Fastener Tape for Detector Belts.

a. Mark the vehicle for primer/fastener tape application along the areas where the belts will be routed. Those areas are described in the following paragraphs.

CAUTION

To avoid damaging the belt, place the belt two (2) inches away from the rear edge of the sliding mantle plate.

b. The belt labeled Right/Front starts approximately one (1) to six (6) inches from the left of the front left turret crease, and ends with the belt connector on the right rear corner of the turret. At the front of the turret, the belt will form a "collar" around the mantle. (See Figures 2-17 and 2-18.)

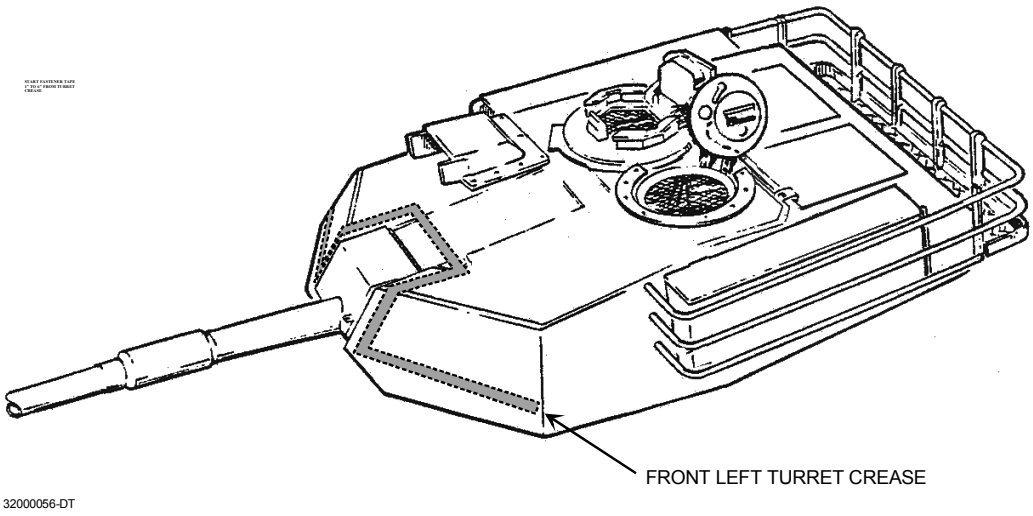


Figure 2-17. M1A1/M1A2 Fastener Tape - Front-Left Turret Crease.

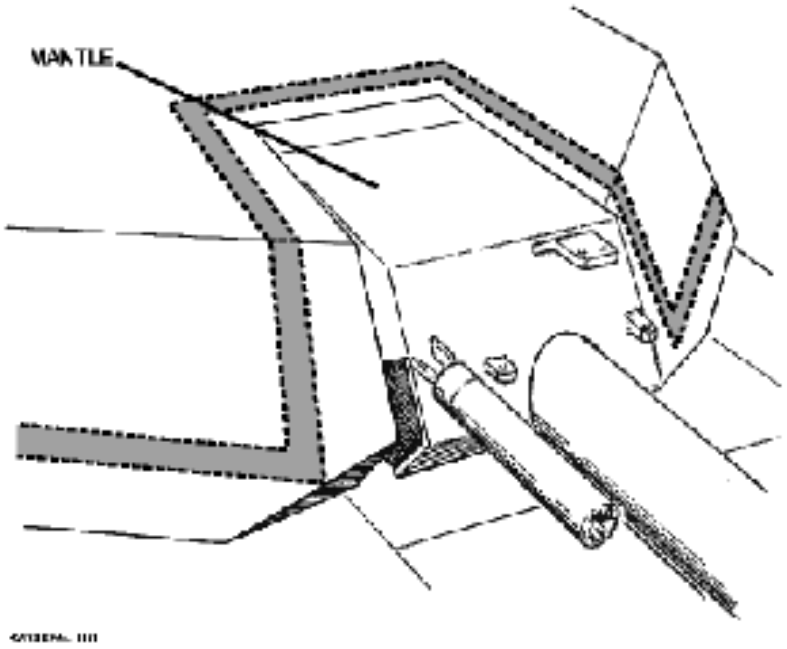


Figure 2-18. M1A1/M1A2 Fastener Tape - Mantle

c. The belt labeled **Left/Rear** starts at the left front side, behind the turret crease, goes along the left side of the turret, across the bottom of the bustle rack, and ends with the belt connector at the right back side of the bustle rack. Mark the outline of each belt on the turret and bustle.

d. The belt is most easily applied by first centering the four (4) rear detectors across the bottom of the bustle rack.

e. Cut fastener tape to the appropriate lengths as indicated in steps a. and b. above.

2.3.2.3.2 **Fastener Tape** Preparation Much of the MILES 2000 equipment is mounted with fastener tape. If fastener tape is not affixed to the vehicle already, or if existing tape is worn and/or unserviceable, remove any existing tape and use the following directions to apply/reapply the fastener tape:

a. Clean all areas where fastener tape is to be installed with water, a brush, if necessary, and rags. Tape will not adhere to a dirty, wet, or oily surfaces. (See Figure 2-19.)

WARNING

Tape primer is toxic and highly flammable. Do not spray near heat, open flame, or sparks. Use primer only in well-ventilated areas. Do not permit smoking in the areas. Injury to personnel may result.

b. Spray a heavy coat of tape primer on the cleaned areas along the strip where the fastener tape will be applied. Allow primer to dry thoroughly (follow the directions on the primer can) before applying the fastener tape. (See Figure 2-20.)

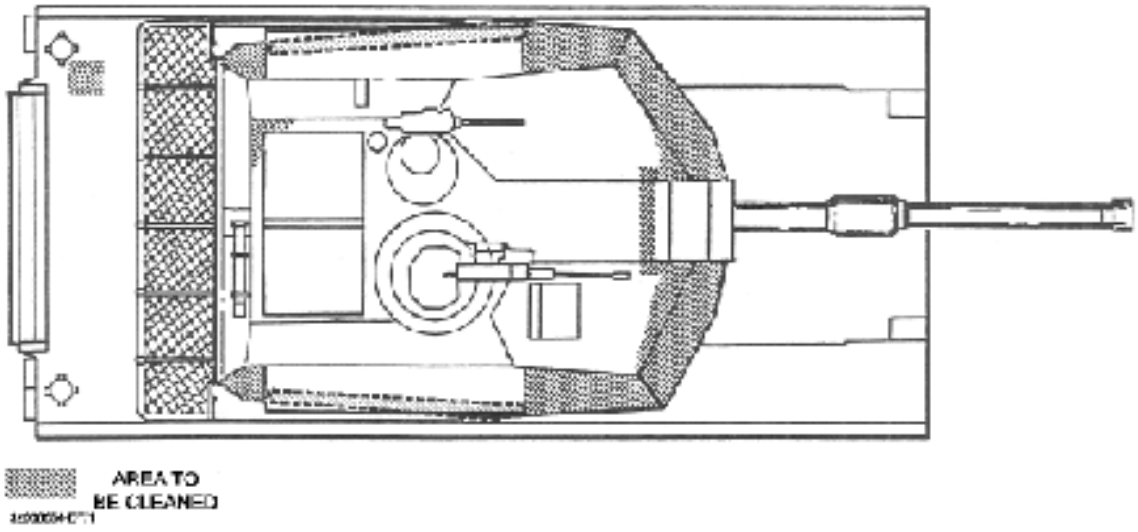


Figure 2-19. M1A1/M1A2 Area of Vehicle to be Cleaned Prior to Adding

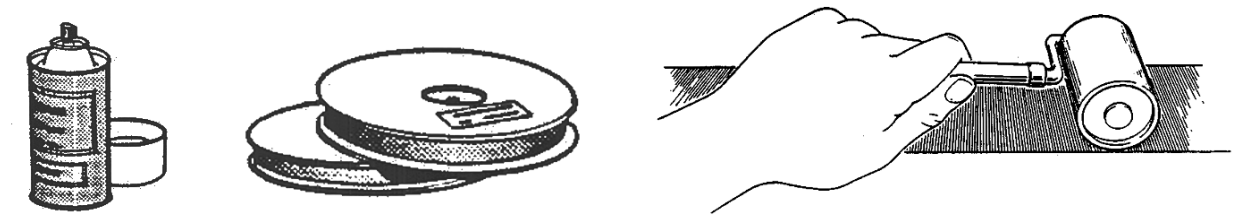


Figure 2-20. Fastener Tape Preparation.

NOTE

The fastener tape has a protective backing. When applying short lengths of tape, remove all the backing before installing the tape. When applying longer lengths, remove the backing gradually as you apply the tape. This will help keep the tape adhesive from sticking to itself or to the wrong surface.

The quadrants of the vehicle-left/front, right/front, left/rear, right/rear are determined from the driver's viewpoint, which would be as facing towards the front of the vehicle. All installation instructions are given from this viewpoint, even though at times the installer may be facing to the rear of the vehicle.

NOTE

MILES equipment installation procedures should be followed as outlined in the technical manual. If the following procedures CANNOT be followed due to cable length or additional vehicle equipment, then place the MILES equipment in the best and safest location.

2.3.2.3.3 Fastener Tape (Right/Front)

a. Beginning at the front left turret crease (Figure 2-17), apply fastener tape to match the outline.

b. Continue applying fastener tape around the mantle, and along the right side, immediately above the Towing Cable, ending at the right rear side. (See Figure 2-18.)

2.3.2.3.4 Fastener Tape (Left/Rear).

a. Begin by applying fastener tape at the left front side behind the turret crease, and continue installing tape immediately above the Towing Cable hooks

b. Apply fastener tape across the rear of the bustle rack, ending at the back right side of the bustle rack. (See Figure 2-21.)

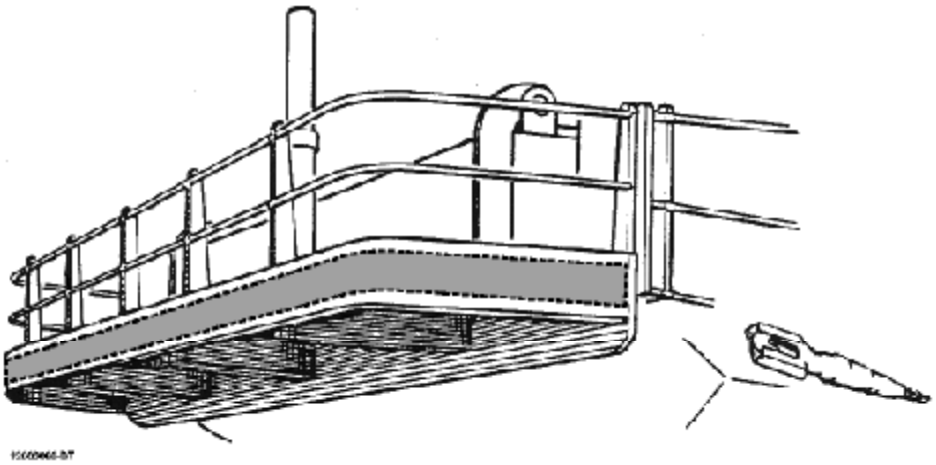


Figure 2-21. M1A1/M1A2 Fastener Tape - Bustle Rack.

2.3.2.4 Detector Belts.

a. Remove detector belts from the transit case and inspect belt segments for damage.

b. Wipe all detectors clean.

c Inspect connectors for dirt and/or damage.

d. Replace and report damaged equipment as required.

CAUTION

Do not spill fuel on detector belts or fastener tape. Fuel dissolves the adhesive properties of the tape primer and may cause a detector belt to fall from the tank, causing damage or loss of a detector belt.

e. For ease of installation, form the collar around the mantle first when attaching the detector belt. Then, working in short sections, press the detector belt labeled **Right/Fron**t along the fastener tape applied for that belt. Ensure that there are no buckles or creases in the belt. The connector for the System Cable should be positioned at the right rear corner of the turret. (See Figure 2-22.)

f. Working in short sections, press the detector belt labeled **Left/Rear** along the fastener tape applied for that belt. Ensure that there are no buckles or creases in the belt. The connector for the System Cable should be positioned at the right rear corner of the bustle rack.

g. Using the fastener tape tie-wraps, secure the connectors safely to or under the bustle rack.

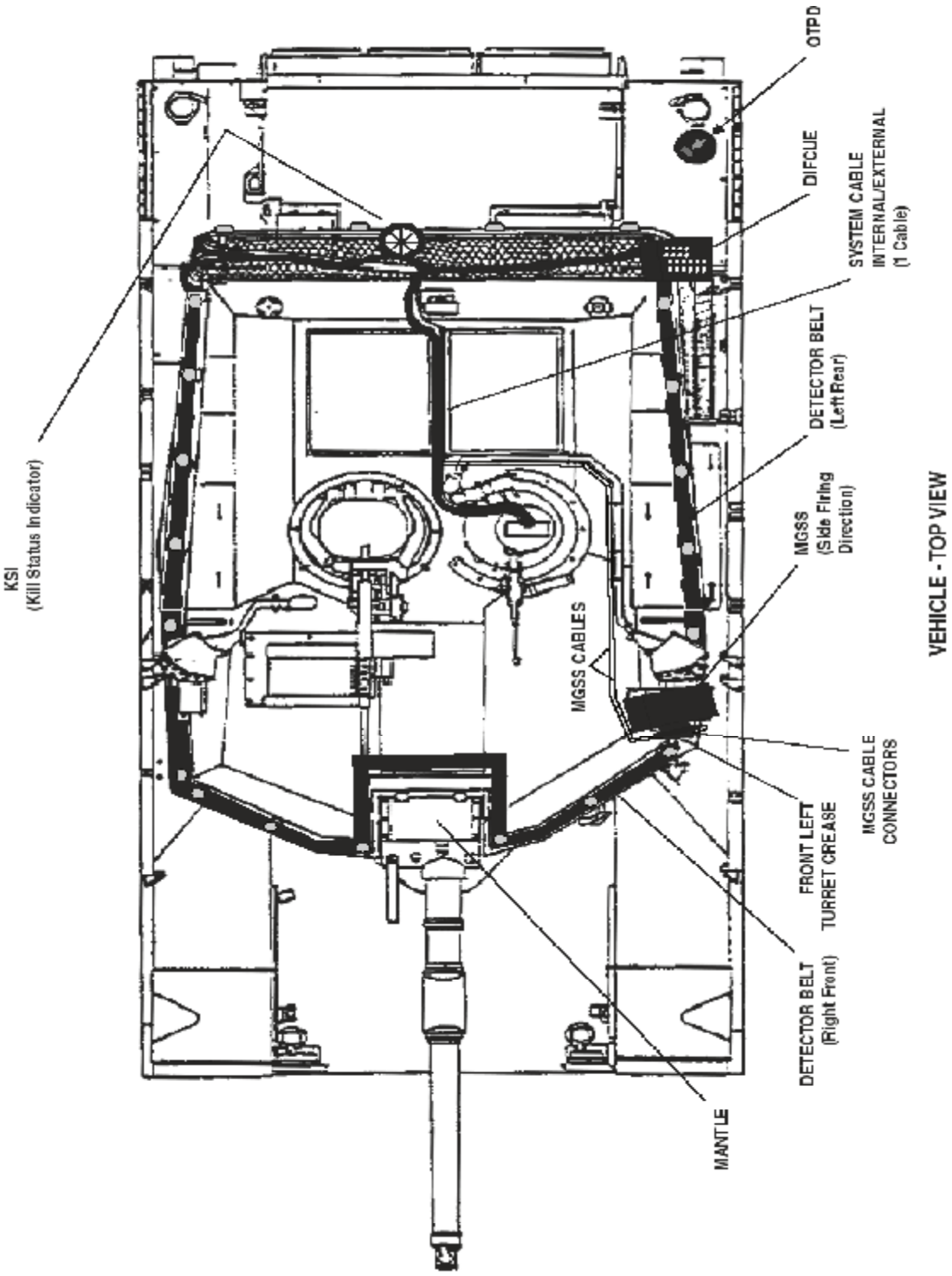


Figure 2-22. M1A1/M1A2 Vehicle Detector Belt Placement (Top View)

2.3.2.5 Kill Status Indicator (KSI).

a. Remove the KSI and the mast adapter assembly from the transit case.

b. Inspect strobe assembly of the KSI for cracks.

c. Inspect connector for dirt and/or damage.

d. Replace and report damaged equipment, as required.

e. Place the KSI and mast adapter assembly in the center of the bustle rack, so that the plate on the lower part of the adapter slips through the opening on the bottom rim of the bustle rack. Turn the adapter plate 90 to secure the bottom of the adapter to the lower right side of the bustle rack. (See Figure 2-23.)

f Secure the adapter to the top rail of the bustle rack using the U-bolt provided with the adapter assemblies. (See Figure 2-24.)

NOTE

For the following step, make sure that the KSI and the adapter are lined up as described in step g. before placing them together. The fastener tape will make it difficult to separate the units to realign them.

g. After matching the center bolt with the mounting hole, and the fastener tape patterns on the bottom of the KSI and at top of the mast adapter assembly, make sure that the four rubber latches on the adapter assembly are in line with the four (4) latching brackets on the KSI. Place the KSI securely on the adapter

h. Pull each rubber latch up and fasten it to its latching bracket.

2.3.2.6 MGSS Installation. Refer to TD 9-6920-892-10/TM 6920/08953A-10/11 for installation instructions.

2.3.27 DIFCUE Installation. Refer to TD 9-6920-892-10/TM 6920-10/5 for installation instructions.

2.3.2.8 Coax Microphone Assembly.

a. Remove the Coax Microphone assembly (Figure 2-25) from the transit case and inspect the microphone for damage.

b. Inspect connector for dirt and/or damage.

c. Replace and report damaged equipment as required.

d. Install a Blank Fire Adapter on the coax machine gun.

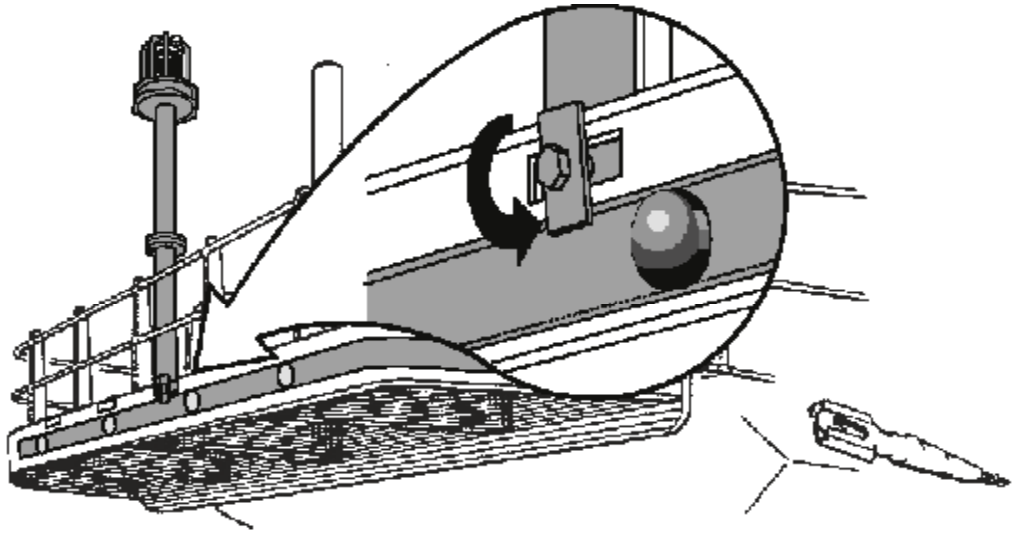


Figure 2-23. M1A1/M1A2 KSI Adapter Assembly Position.

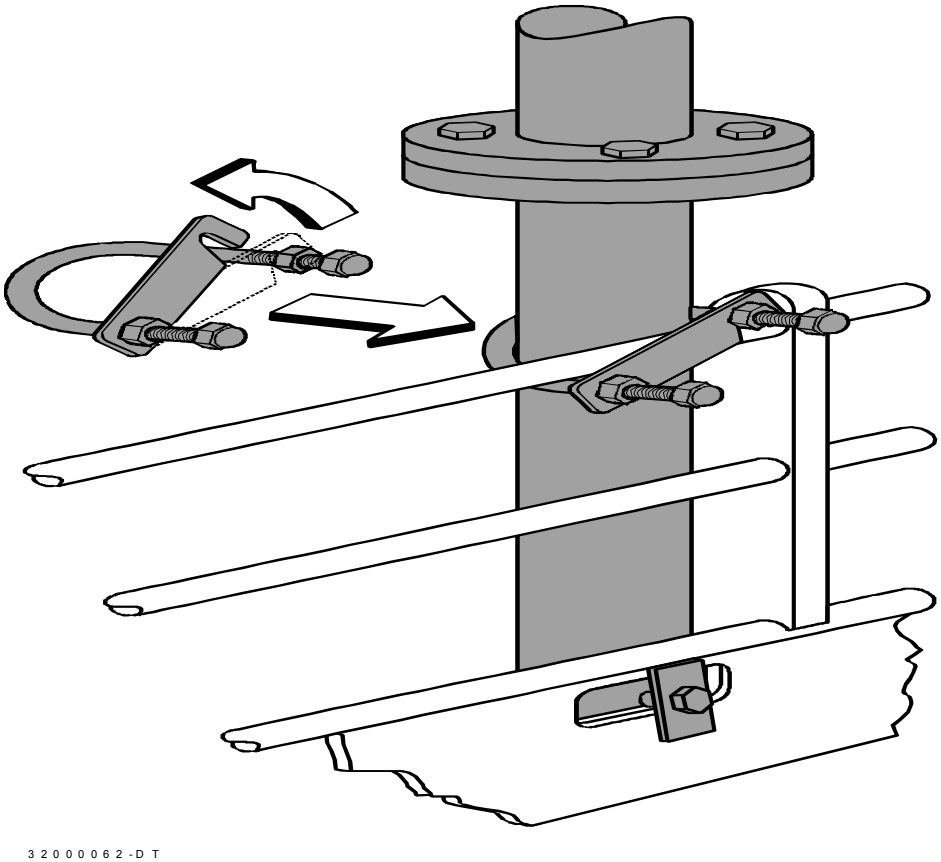


Figure 2-24. M1A1/M1A2 KSI Assembly Secured to Top Rail.

e. Clip the Coax Microphone to the gas tube under the coax machine gun barrel. Route cable through the coax machine gun housing, position it near the main gun breech, and secure so that it does not interfere with normal operations. (See Figure 2-26.)

CAUTION

Blank fire can heat up the barrel and damage the cable if the cable touches the barrel.

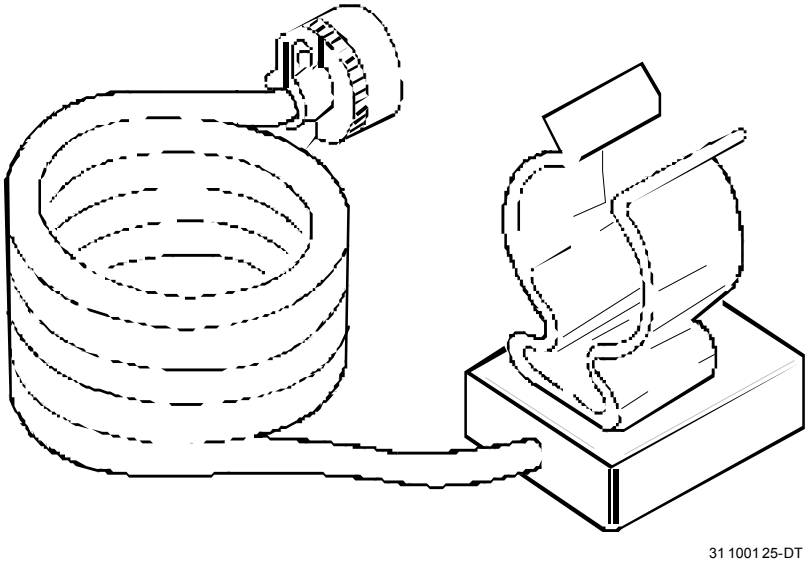


Figure 2-25. M1A1/M1A2 Coax Microphone Assembly.

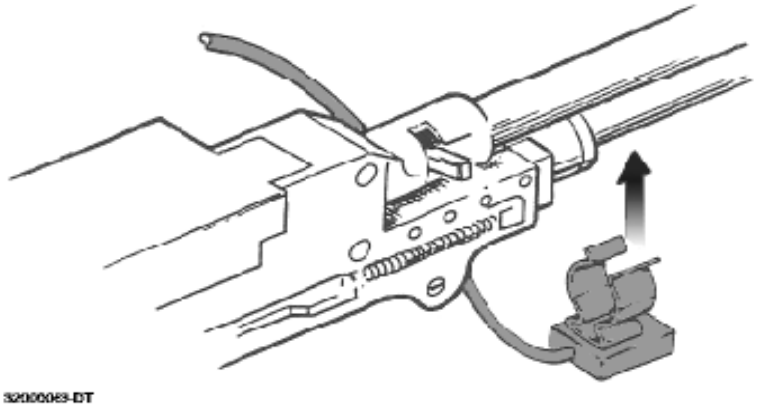


Figure 2-26. M1A1/M1A2 Coax Microphone.

2.3.2.9 System Cable (Exterior Connections).

a. Inspect the entire length of the cable, making sure there are no bare wires exposed, and that the cable has not been damaged in any way.

b. Inspect connectors for dirt and/or damage

c. Replace and report damaged equipment, as required

d. Lay out cable on top of the vehicle remembering to route the cables between the blow-out doors, not on top of them. Stretch it out and look for the segments labeled KSI, **Right/Front**, and **Left/Rear**. Group these segments together and remove the periscope block from the Loader's Hatch. (See Figure 2-27.)

e. Slide the remaining cable segments into the vehicle. Rotate the periscope down, then route the KSI Right/Front and Left/Rear cables through the periscope block of the loader hatch to the outside of the vehicle.

f. Once the cable segments are outside, install the periscope block grommet by pushing firmly and ensuring a snug fit.

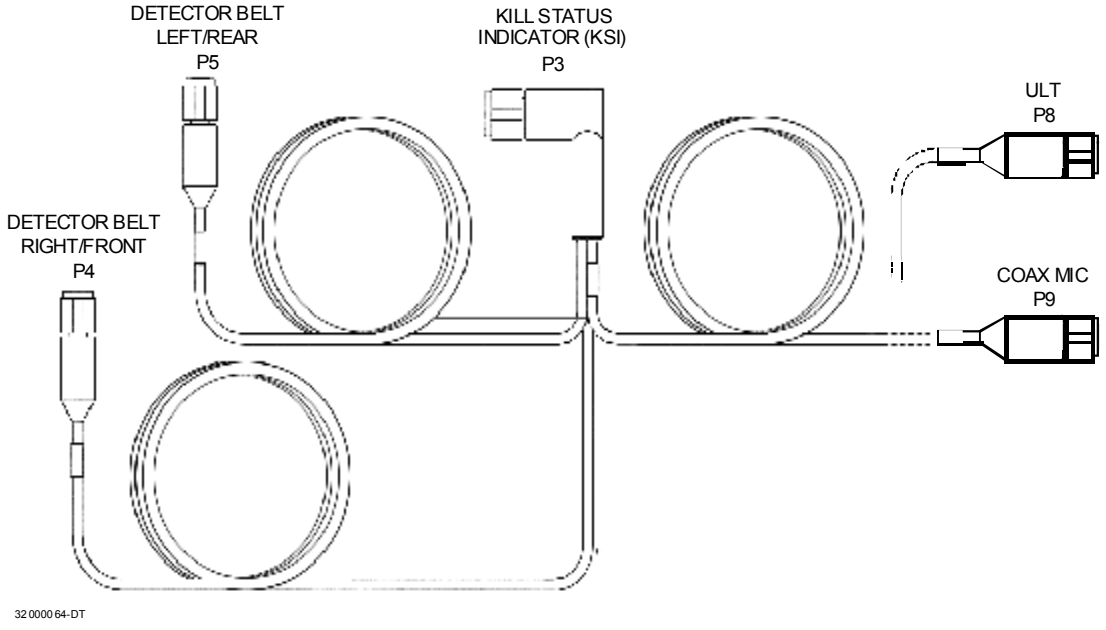


Figure 2-27. M1A1/M1A2 System Cable, Ext. Connections.

NOTE

Route the cables and connect them to the individual units, using fastener tape tie-wraps at intervals to secure the cables safely out of the way.

Remember to route the cables between the blow-out doors, not over on them

Letter/number designators are shown in parenthesis. For example: (P3) or (J1). The designators have been added to identify connectors. Each system cable segment is color coded and labeled with its unique designator as well as with the name of the unit to which the segment should be connected

Cable segments are labeled with "P" (plug) and "J" (jack) designators as shown in the following example: "P1/J2," where P1 indicates that the connector of that cable segment is plug #1, and J2 indicates the routing destination, jack #2, of the equipment/cable to which the cable segment is being routed. The installation instructions of this manual identify the equipment/cable to which each cable segment is to be routed

g. Route segment (P3-green sleeve) to the KSI and attach (P3) to (J1).

h. Route the detector belt cables to the right rear side of the turret. Connect the segment labeled **Left/Rear** (P5-gray sleeve) to (J1) of the detector belt; and the segment labeled **Right/Front** (P4-white sleeve) to (J1) of the detector belt.

i. Secure all cables out of the way with fastener tape tie-wraps.

2.3.2.10 Universal Laser Transmitter (ULT)

a. Remove the ULT with the attached ULT adapter from the transit case and inspect for damage. (See Figure 2-28.) Remove the two (2) bolts from the top of the adapter. Keep them with you.

b. Inspect connector for dirt and/or damage

c. Replace and report damaged equipment as required

d. Remove the ASV cap deflector and lower the breech with the breech handles. Depress the main gun

e. To allow firing of the main gun, perform one of the following:

Turn off Master Power and Turret Power, lock main gun to the ceiling, and place Turret in manual mode. Remove wire 1E100 (+) from right underside of main gun mount.

f. Holding the ULT adapter at a 45 angle, slide the ULT adapter into the main gun breech (with the ULT connector facing towards the installer), and slide the rear adapter tabs over the flanges on each side of the breech. (See Figure 2-29).

g. Ensure the mounting holes on the top of the adapter are lined up with the mounting holes on top of the breech. Using the bolts you removed from the adapter, starting at the

top, bolt the adapter to the breech. Bolt the tabs at the end of the ULT adapter. (See Figure 2-30). Ensure that it is secure.

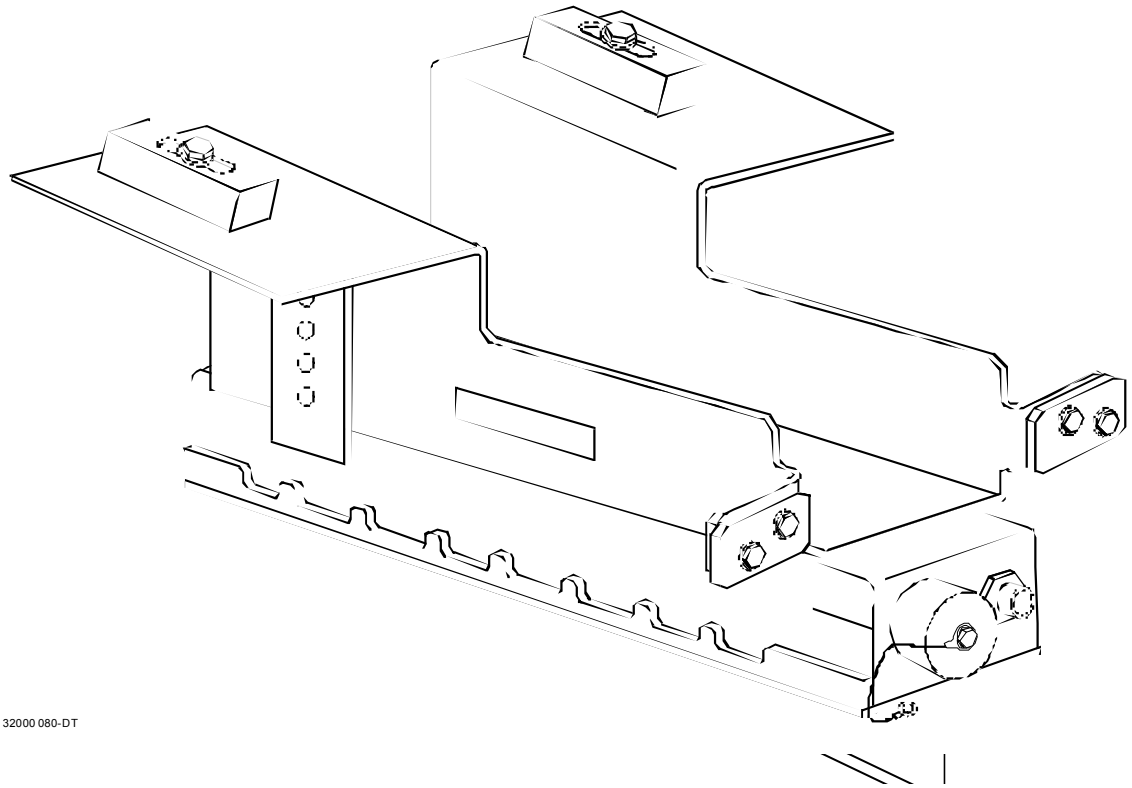


Figure 2-28. M1A1/M1A2 ULT and Adapter Assembly.

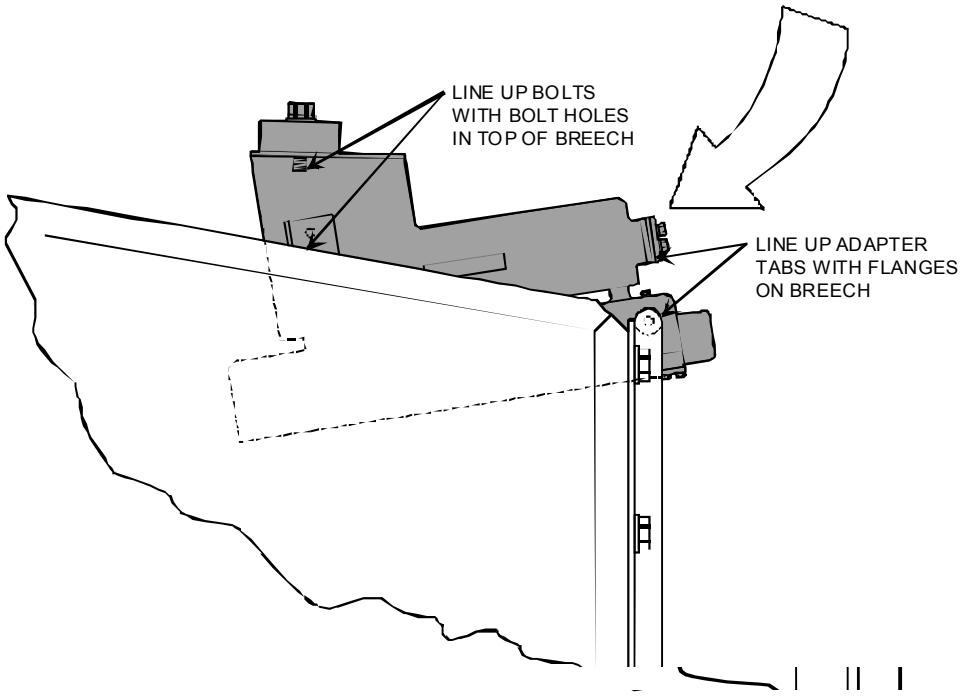


Figure 2-29. M1A1/M1A2 Inserting ULT Assembly into Breech.

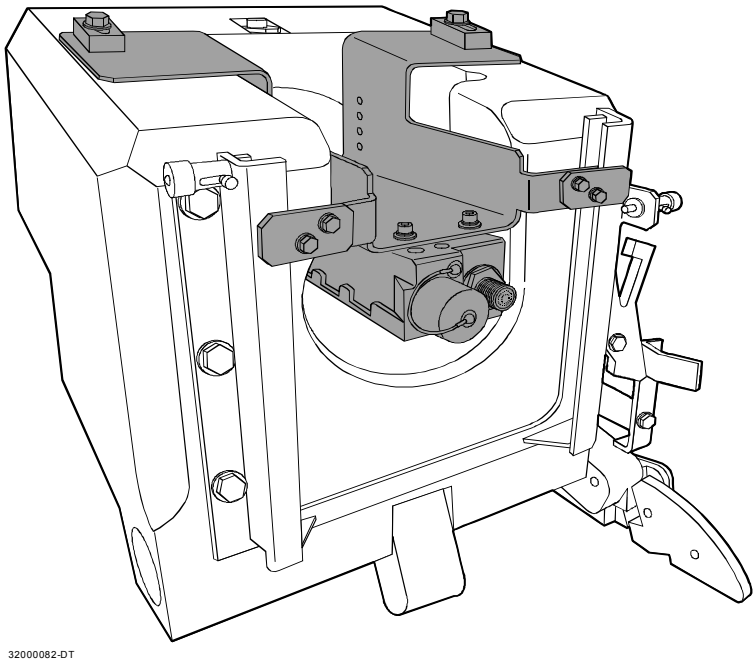


Figure 2-30. M1A1/M1A2 ULT Assembly in Breech

2.3.2.11 Control Unit (CU).

a. Remove the CU from the transit case and inspect for cracks or broken display window and membrane switches.

b. Inspect connector for dirt and/or damage.

c. Replace and report damaged equipment as required.

d. There should be a strip of fastener tape covering the back of the unit. If this strip is not present, apply one using the same method used to apply fastener tape to the vehicle. Refer to paragraph 2.3.2.3.2 for fastener tape preparation.

e. Attach fastener tape to the wall in the commander's station. Mount the CU to the fastener tape and ensure that it is firmly seated. (See Figure 2-31.)

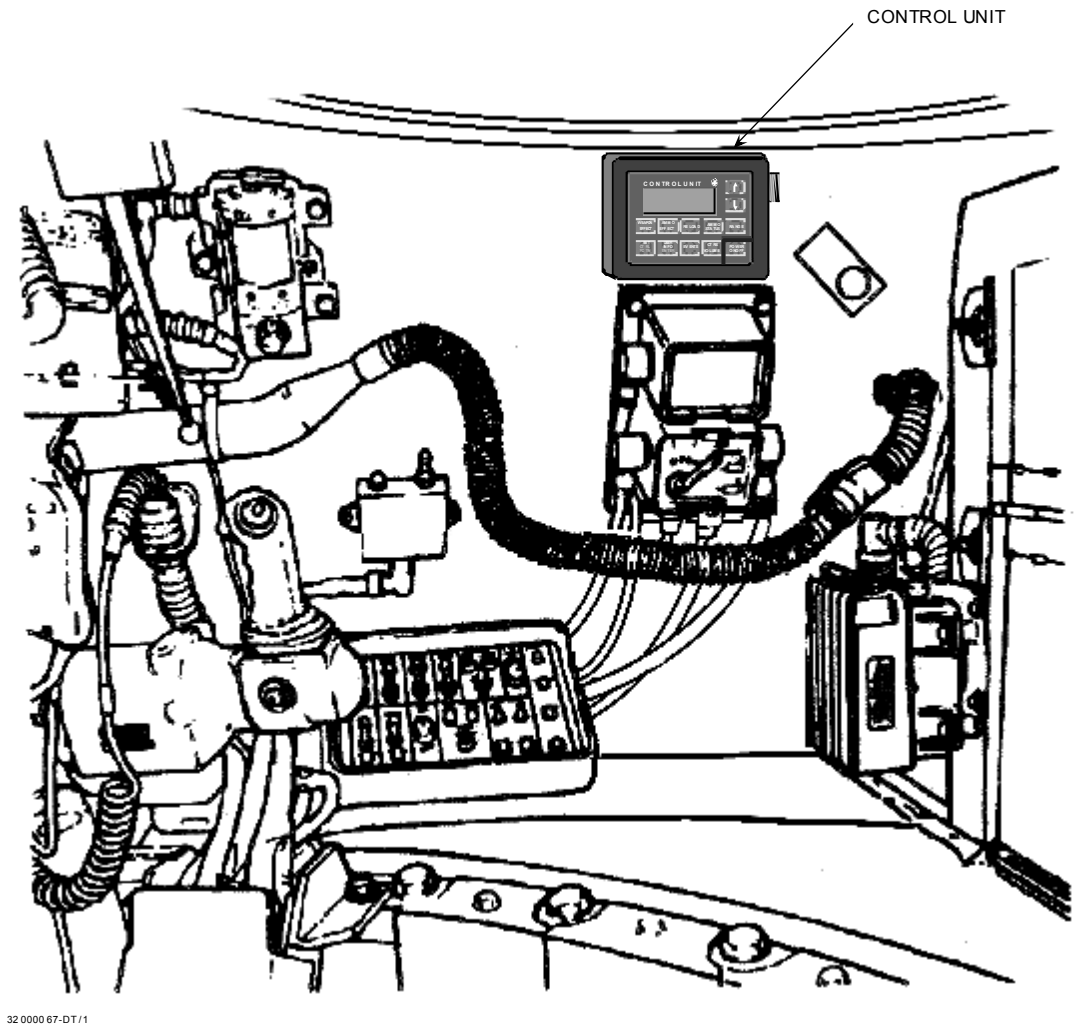


Figure 2-31. M1A1/M1A2 Control Unit (CU).

2.3.2.12 Power Controller.

a. Remove the Power Controller from the transit case and inspect for damage.

b. Inspect connector for dirt and/or damage.

c. Replace and report damaged equipment as required.

d. There should be two (2) strips of fastener tape covering the bottom of the unit. If these strips are not present, apply them using the same method used to apply fastener tape to the vehicle. Refer to paragraph 2.3.2.3.2 for fastener tape preparation.

e. Attach fastener tape below the loaders shelf on the side of the turret ring on the right side of the loader seat. Mount the Power Controller to the fastener tape ensuring that it is firmly seated and that the LEDs are in plain sight.(See Figure 2-32.)

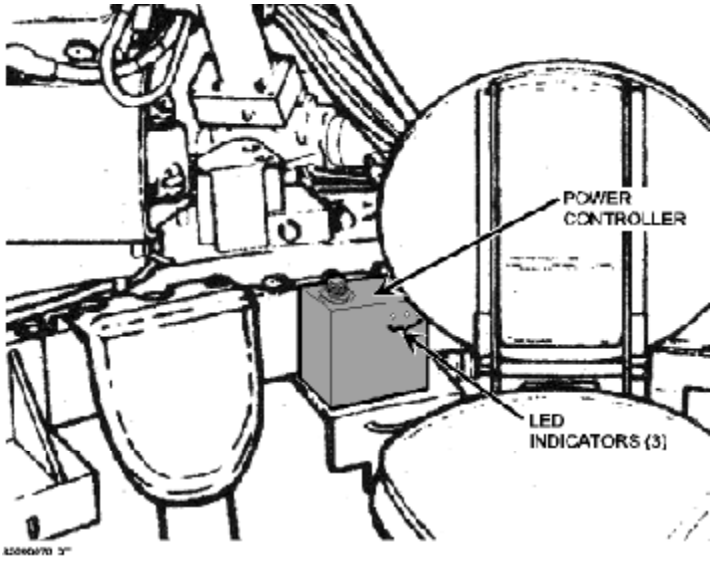


Figure 2-32. M1A1/M1A2 Power Controller.

2.3.2.13 Loader Unit (LU).

a. Remove the LU from the transit case and inspect for cracks or broken display window and membrane switches.

b. Inspect connector for dirt and/or damage.

c. Replace and report damaged equipment as required.

d. There should be a strip of fastener tape covering the back of the unit. If this strip is not present, apply one using the same method used to apply fastener tape to the vehicle. Refer to paragraph 2.3.2.3.2 for fastener tape preparation.

e. Attach fastener tape to the turret wall in between the ammo door and the AM 1780/MCS.

f. Mount the LU to the fastener tape. Ensure the unit is firmly seated. (See Figure 2-33.)

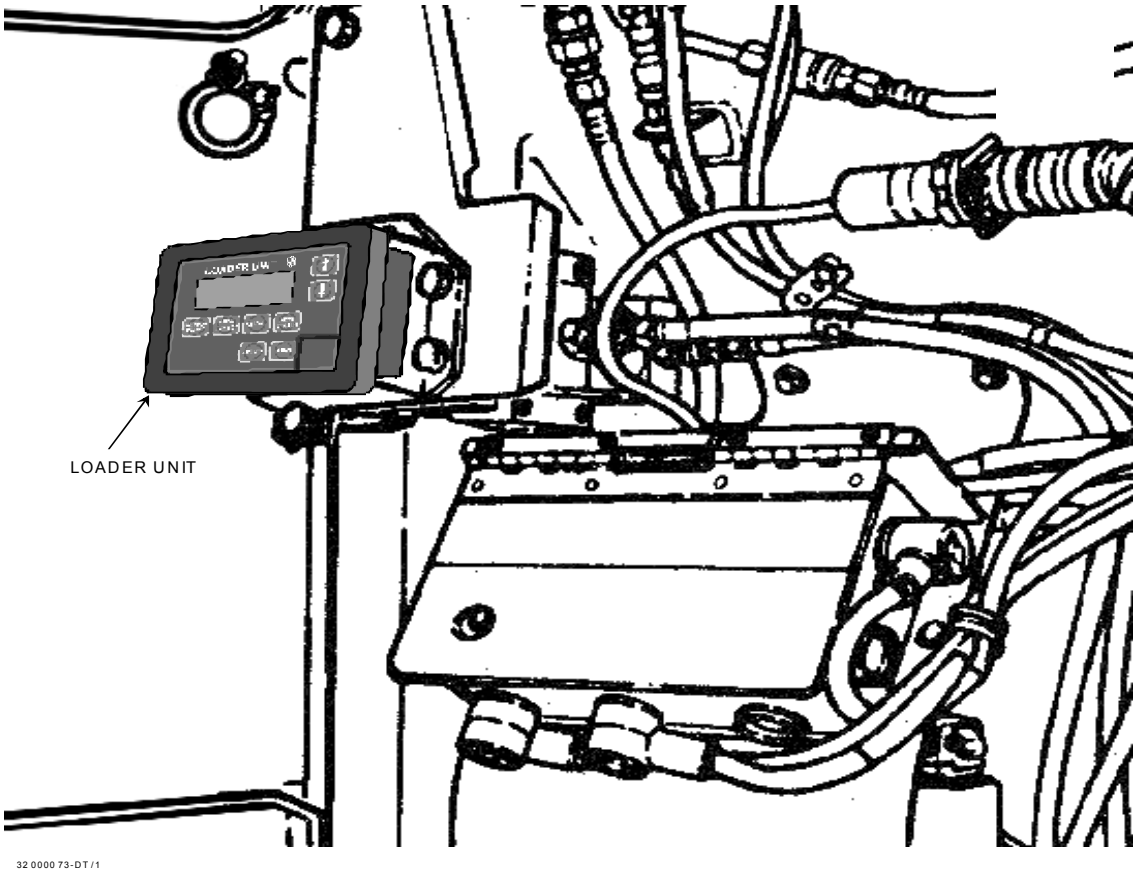


Figure 2-33. M1A1/M1A2 Loader Unit Mounting.

2.3.2.14 System Cable (Interior ONLY).

CAUTION
Ensure power is off prior to performing the following procedures

2.3.2.14.1 M1A1 VIC System Cable. (See Figure 2-34.)

a. Route segment (P7) and segment (J2) to the AM-1780 amplifier and connect (P7) to the (J503) connector on the amplifier. Connect (J2) to the removed cable connector. (See Figures 2-35 and 2-36.)

b. Route segment (P6) and segment (J1) to the AM-1780 amplifier at the loader station and connect (P6) to the (J501) connector on the amplifier. Connect (J1) to the removed cable connector.

c. There will be two insulated wires, stripped at the ends and tinned, attached to the System Cable near the segments connected to the amplifier. Connect the tinned part of the (-) wire to the Audio binding post on the AM-1780. Connect the tinned part of the (+) wire to the other Audio binding post on theAM-1780.

d. Route the Turret Network Box (TNB) segment (P12 & P13) to the turret network box and connect (P12 & P13) to TEST JACKS 1 & 2 on the TNB. (See Figure 2-43.)

e. Route segment (P10-yellow sleeve) to the LU and connect (P10) to (J1) of the LU. (See Figure 2-37.)

f. Route segment (P8-blue sleeve) to the main gun breech. Connect (P8) to (J1) ULT. (See Figure 2-38.)

g. Route segment (P9-brown sleeve) to the Coax Microphone assembly attached to the main gun in the breech and connect (P9) to (J1) on the Coax Microphone assembly.

h. Route segment (P1-violet sleeve) to the Power Controller and connect (P1) to (J1) of the Power Controller. (See Figure 2-39.)

i. Route segment (P2-red sleeve) to the CU and connect (P2) to (J1) of the CU. (See Figure 2-40.)

j. Secure all cables out of the way with fastener tape tie-wraps.

2.3.2.14.2 M1A1/A2 Combined VIC System Cable (PN 146460). (See Figure 2-41.)

CAUTION

Ensure power is off prior to performing the following procedures

a. Route segment (P7) and segment (J2) to the AM-1780 amplifier and connect (P7) to the (J503) connector on the amplifier. Connect (J2) to the removed cable connector.

b. Route segment (P6) and segment (J1) to the AM-1780 amplifier at the loader station and connect (P6) to the (J501) connector on the amplifier. Connect (J1) to the removed cable connector. (See Figure 2-42.)

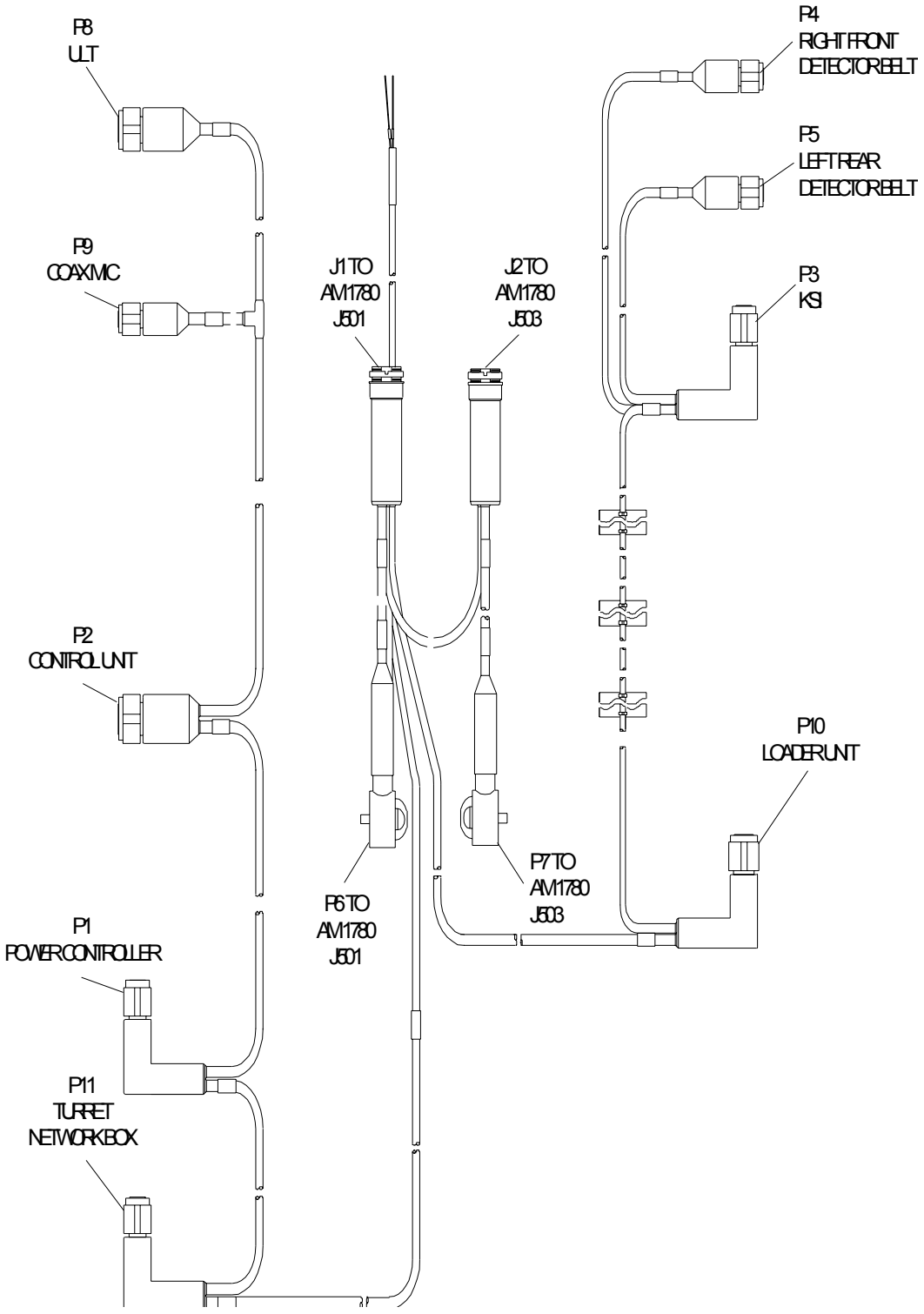


Figure 2-34. M1A1 VIC Internal/External System Cable Assembly.

74-D172
4641C

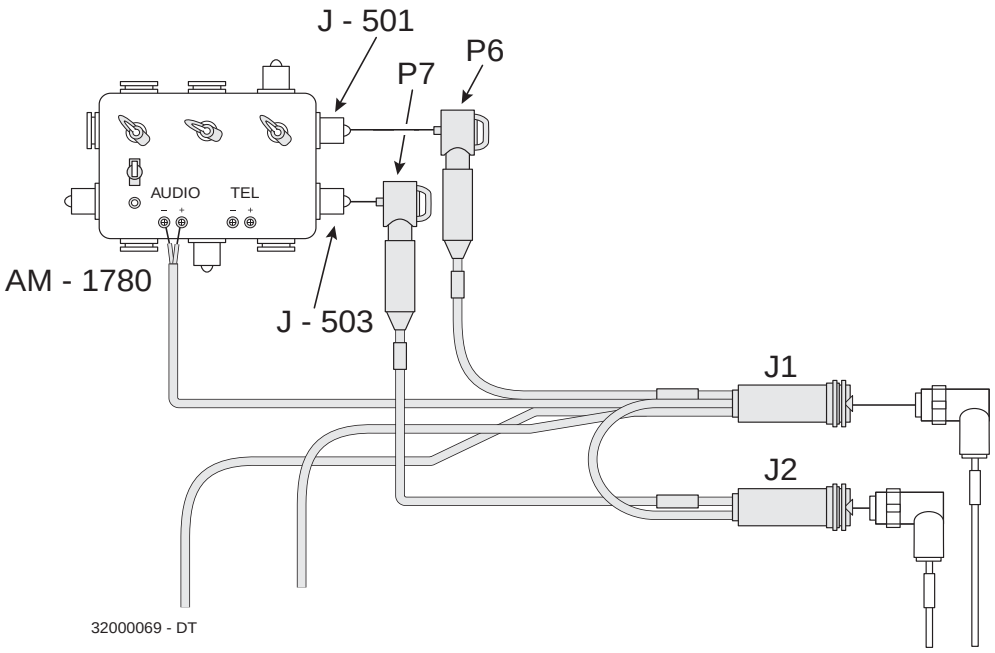


Figure 2-35. Cable routing to AM-1780 Amplifier.

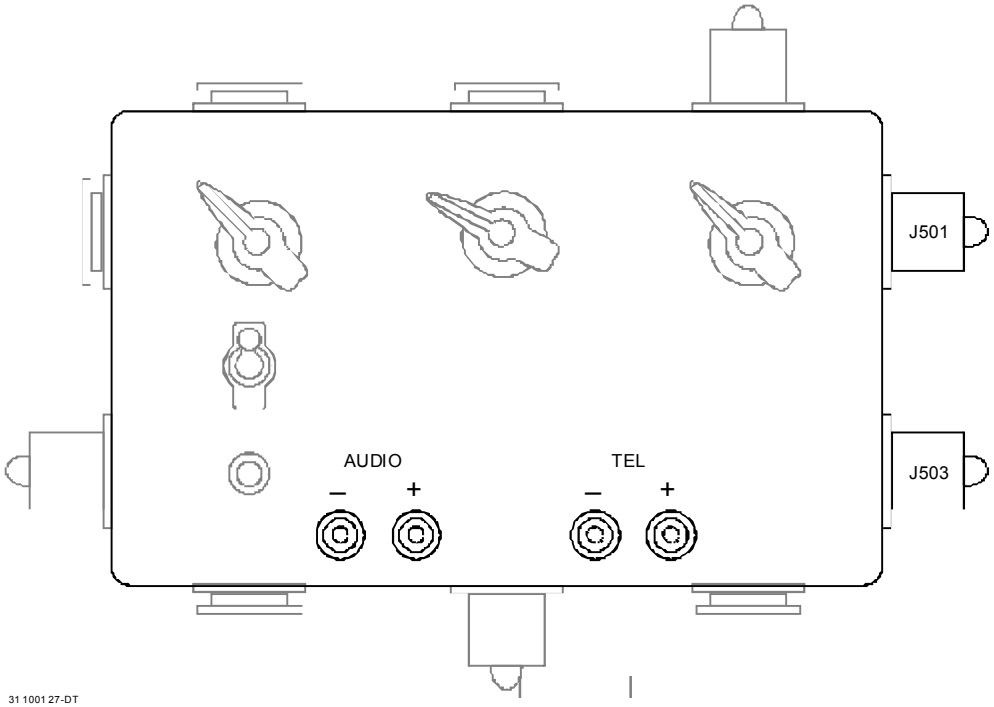


Figure 2-36. AM 1780 Amplifier.

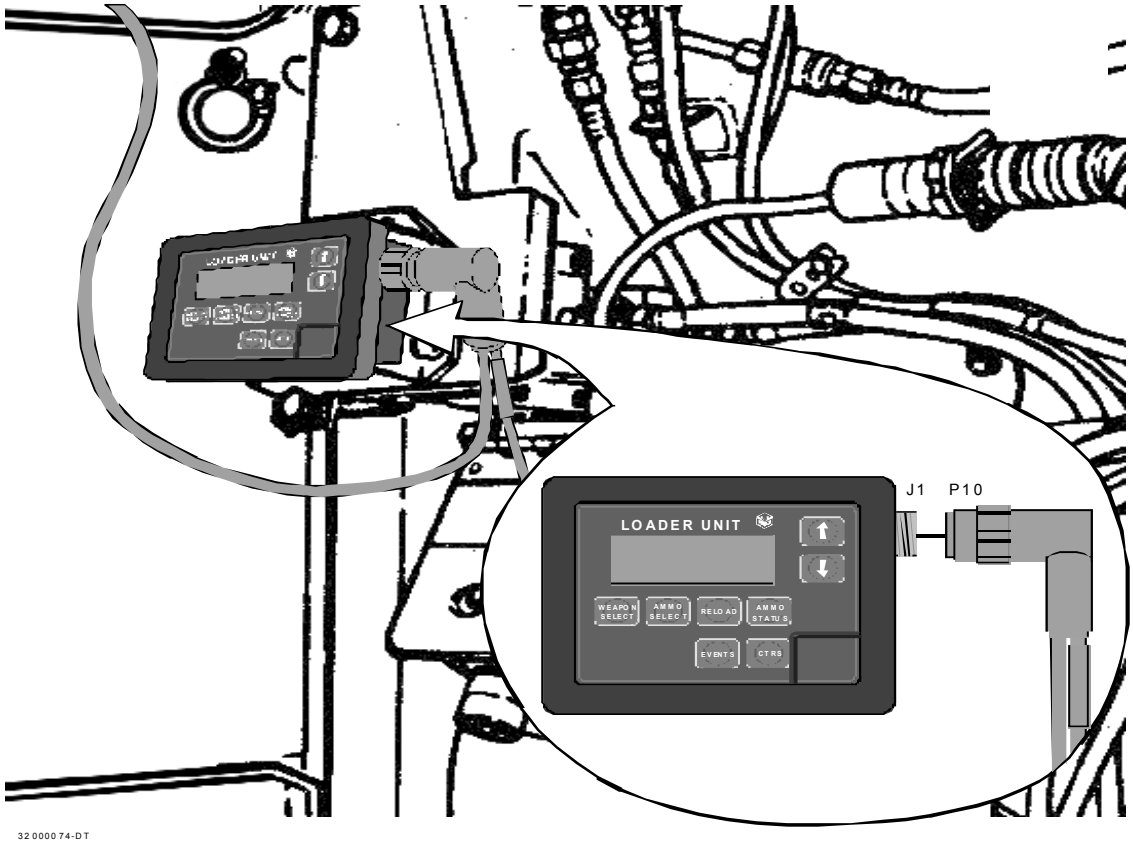


Figure 2-37. M1A1/M1A2 Loader Unit Connection to System Cable.

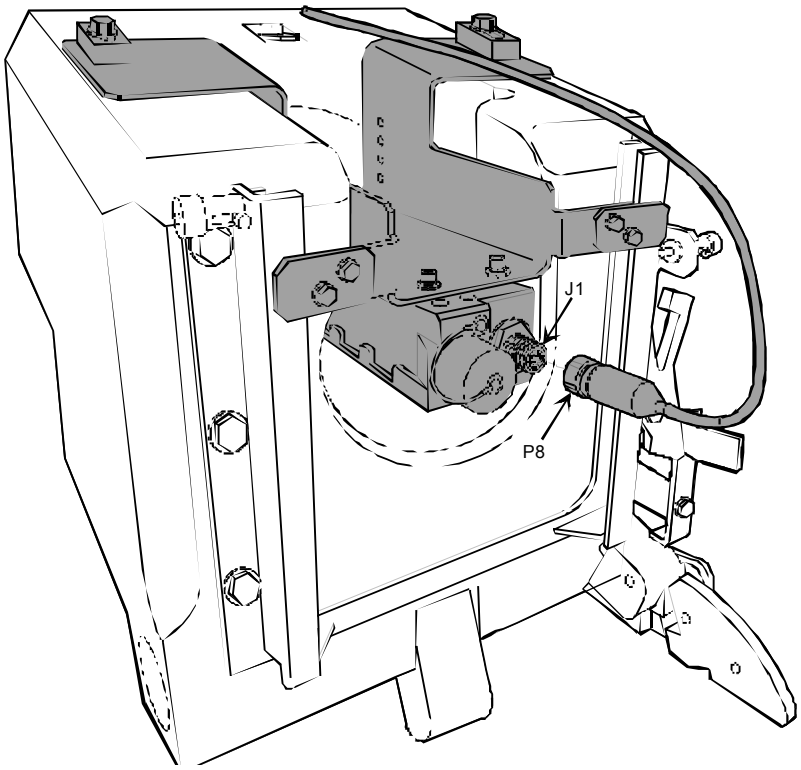


Figure 2-38. M1A1/M1A2 System Cable Connection to ULT.

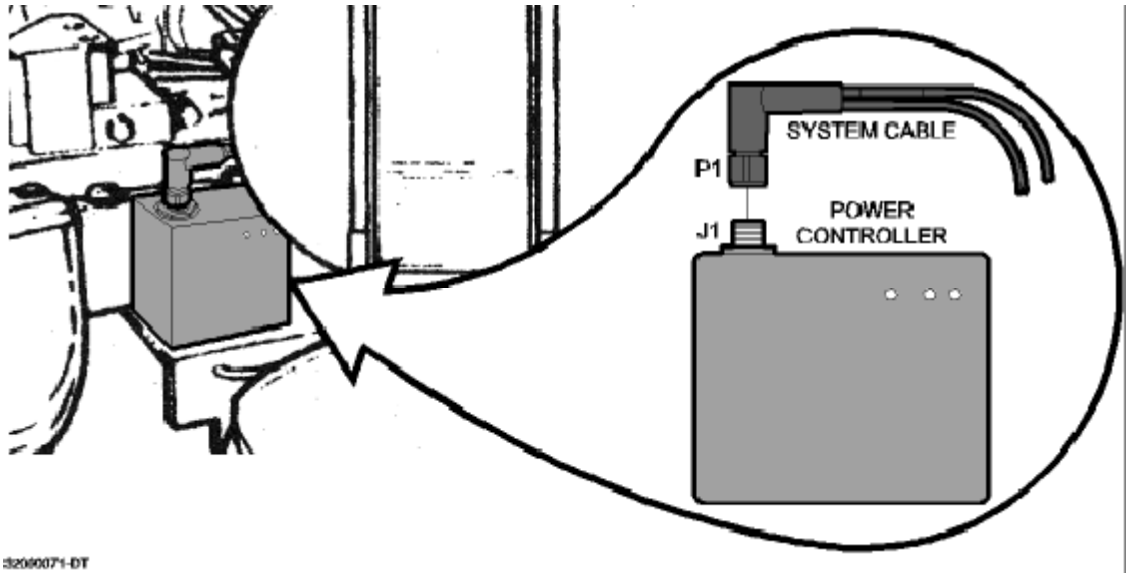


Figure 2-39. M1A1/M1A2 System Cable Connection to Power Controller.

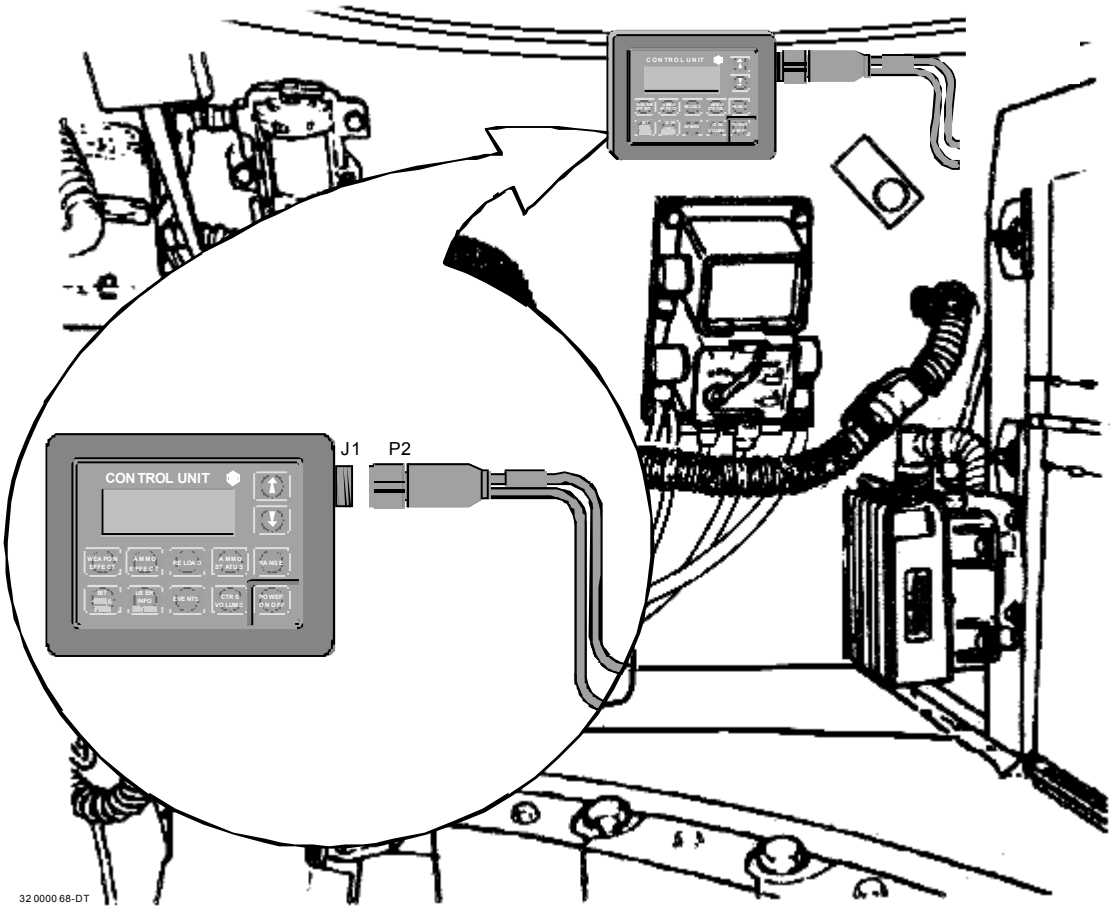


Figure 2-40. M1A1/M1A2 Control Unit Connection to System Cable.

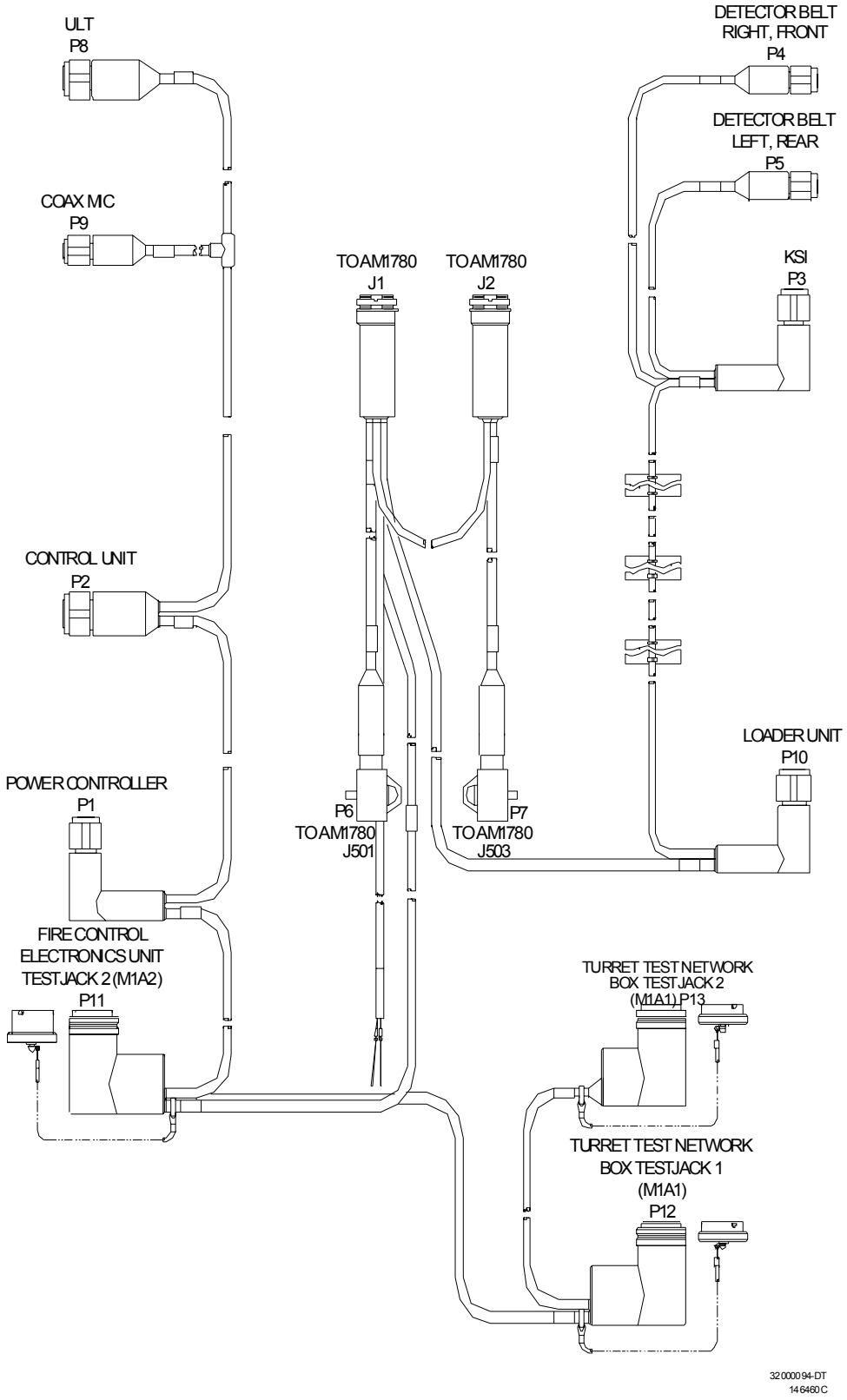


Figure 2-41. M1A1/M1A2 VIC System Cable

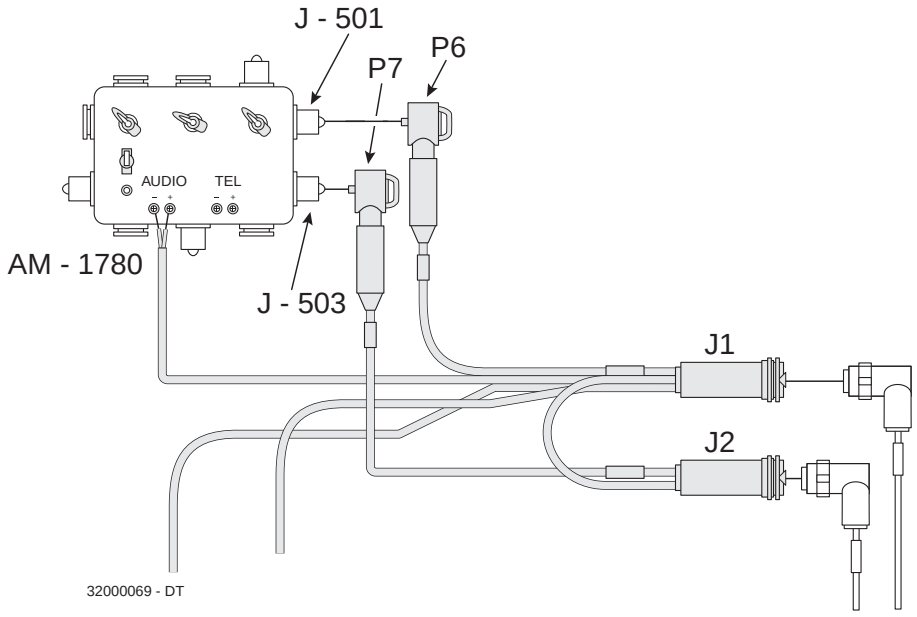


Figure 2-42. Cable Routing to AM-1780 Amplifier.

c. There will be two (2) insulated wires, stripped at the ends and tinned, attached to the System Cable near the segments connected to the amplifier. Connect the tinned part of the (-) wire to the Audio binding post on the AM-1780. Connect the tinned part of the (+) wire to the other Audio binding post on the AM-1780.

d. **M1A1 ONLY** - Route segment (P12) and segment (P13) to the Turret Network Box (TNB). Connect (P12) to TEST JACK 1 and connect (P13) to TEST JACK 2 on the TNB. (See Figure 2-43.)

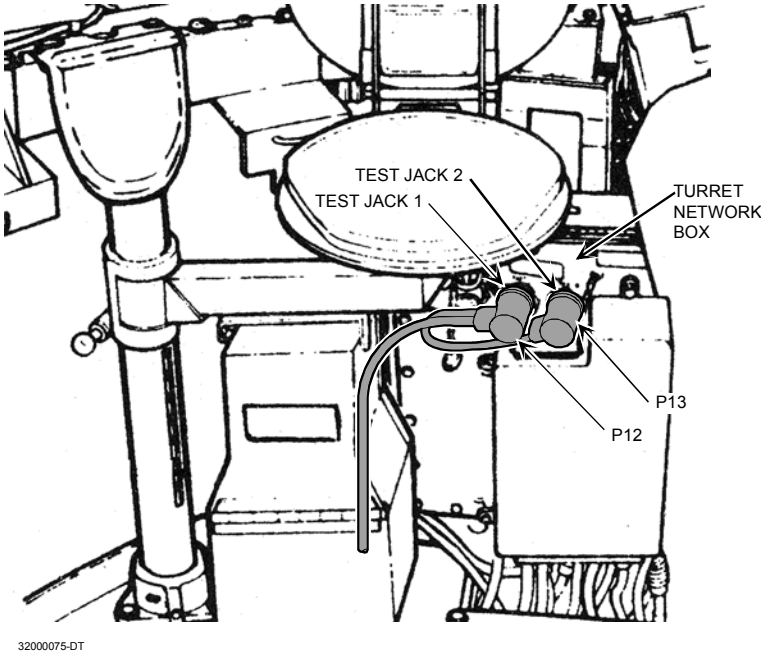


Figure 2-43. M1A1 system Cable Connection to Turret Network Box (TNB).

M1A2 ONLY - Route segment (P11) to the Fire Control Electronics Unit. Remove the 2 bolts holding the floor plate. (See Figure 2-44.) Remove the floor plate and connect (P11) to TEST JACK 2 of the Fire Control Electronics Unit. (See Figure 2-45.) Route cables along the left side of FCU and reinstall floor plate.

e. Route segment (P10-yellow sleeve) to the LU and connect (P10) to (J1) of the LU.

f. Route segment (P8-blue sleeve) to the main gun breech. Connect (P8) to (J1) of the ULT.

g. Route segment (P9-brown sleeve) to the Coax Microphone assembly attached to the main gun in the breech and connect (P9) to (J1) on the Coax Microphone assembly.

h. Route segment (P1-violet sleeve) to the Power Controller and connect (P1) to (J1) of the Power Controller.

i. Route segment (P2-red sleeve) to the CU and connect (P2) to (J1) of the CU.

j. Secure all cables out of the way with fastener tape tie-wraps.

2.3.2.14.3 M1A1/A2 Combined VIS System Cable. (See Figure 2-46.)

CAUTION

Ensure power is off prior to performing the following procedures.

a. Route the Combined VIS System Cables through to the Master Control Station (MCS). **Note**: The MCS may need to be loosened and moved slightly to access Radio B (J1) and Radio A (J2) connectors. (See Figure 2-48.)

b. Remove the J1 (Radio A) and J2 (Radio B) cables from the MCS. (See Figure 2-47)

c. Connect J1 (Radio A) cable to the J1 segment of the VIS System Cable. (See Figure 2-47)

d. Connect J2 (Radio B) cable to the J2 segment of the VIS System Cable. (See Figure 2-47)

e. Connect VIS System Cable segment P7 to J1 (Radio B) on the MCS. (See Figure 2-47)

f. Connect VIS System Cable segment P6 to J2 (Radio A) on the MCS. (See Figure 2-47)

g. There will be two insulated wires, stripped at the ends and tinned, attached to the System Cable near the segments connected to the amplifier. Connect the tinned part of the (-) wire to the (-) lines binding post on the MCS. Connect the tinned part of the (+) wire to the other (+) lines binding post on the MCS.

h. Route segment (P14) and segment (J3) to the MCS power supply and connect (P14) to (J5) of the MCS power supply. Connect (J3) to the removed MCS Power Cable.

i. **M1A1 ONLY** - Route segment (P12) and segment (P13) to the Turret Network Box (TNB). Connect (P12) to TEST JACK 1 and connect (P13) to TEST JACK 2 on the TNB. (See Figure 2-48.)

M1A2 ONLY - Route segment (P11) to the Fire Control Electronics Unit. Remove the 2 bolts holding the floor plate. (See Figure 2-44.) Remove the floor plate and connect (P11) to TEST JACK 2 of the Fire Control Electronics Unit. (See Figure 2-46.) Route cables along the left side of FCU and reinstall floor plate.

j. Route segment (P10-yellow sleeve) to the LU and connect (P10) to (J1) of the LU.

k. Route segment (P8-blue sleeve) to the main gun breech. Connect (P8) to (J1) of the ULT.

l. Route segment (P9-brown sleeve) to the Coax Microphone assembly attached to the main gun in the breech, and connect (P9) to (J1) on the Coax Microphone assembly.

m. Route segment (P1-violet sleeve) to the Power Controller and connect (P1) to (J1) of the Power Controller.

n. Route segment (P2-red sleeve) to the CU and connect (P2) to (J1) of the CU.

o. Secure all cables out of the way with fastener tape tie-wraps.

NOTE

Refer to TM 11-5830-263-10 for controls and indicators, and operation of the Master Control Station.

2.3.2.15 Optical Turret Positioning Device (OTPD).

a. Remove the OTPD from the transit case and inspect for cracks in lens.

b. Replace and report damaged equipment as required.

c. Check to make sure a battery is installed in the OTPD. If there is no battery, or if the battery is bad, loosen the thumbscrew on the battery cover, open the cover, remove the bad battery (if there is one in place), and install a 9-volt battery. Secure the battery door by tightening the thumbscrew

CAUTION

Ensure battery door is securely closed during storage and operations, or damage can occur to the battery door.

d. Position the OTPD on the left rear of the tank so the Infrared Transmitter Window points to the center of the detector belt on the bustle rack as shown in Figure 2-49.

e. Power up the system and run BIT. If BIT fails, reposition the OTPD and rerun BIT. (Do this until BIT passes.) When BIT passes, mark the position of the OTPD.

f. Apply fastener tape to the OTPD and to the left rear corner (as looking from the rear of the vehicle forward) of the hull behind the turret. Refer to paragraph 2.3.2.3.2 for fastener tape preparation.

g. Attach the OTPD to the fastener tape on the hull, and attach lanyard near the fuel filler cap.

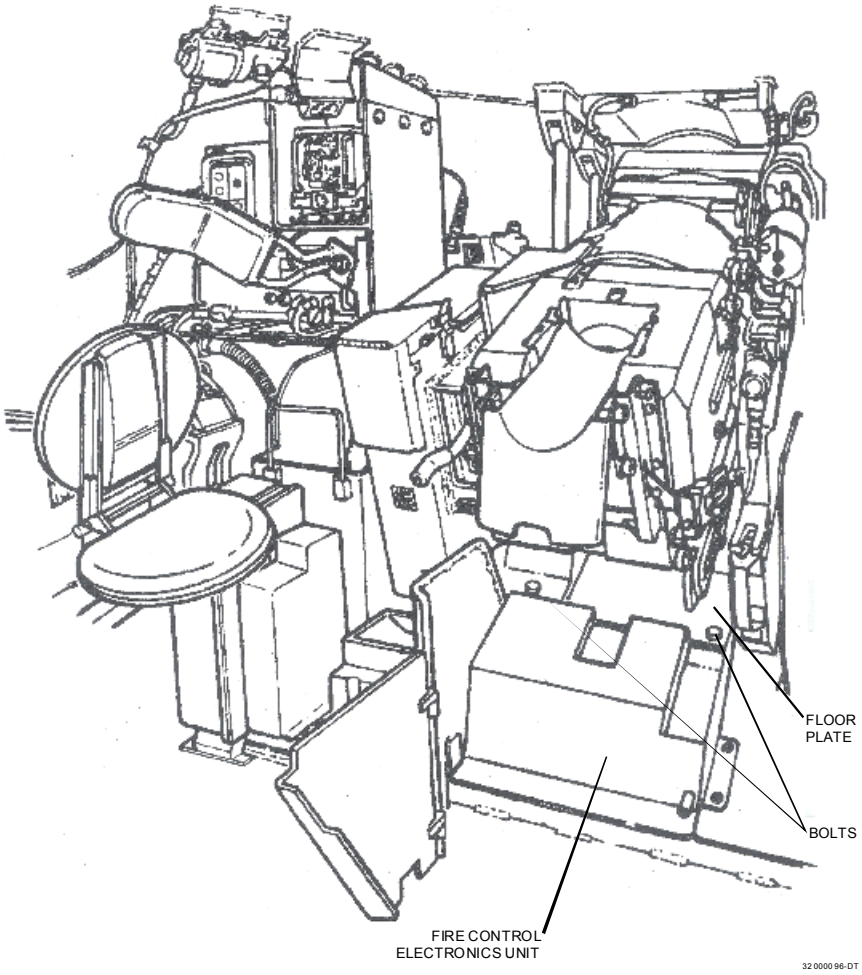


Figure 2-44. M1A2 Fire Control Electronics Unit Access.

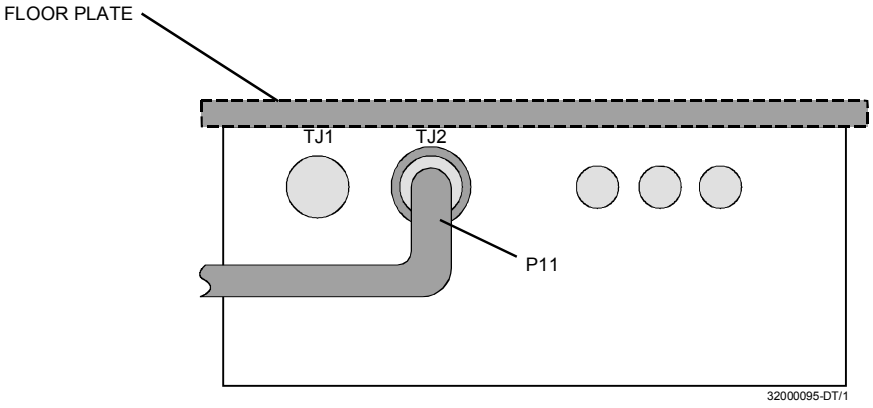


Figure 2-45. M1A2 Fire Control Electronics Unit Connection

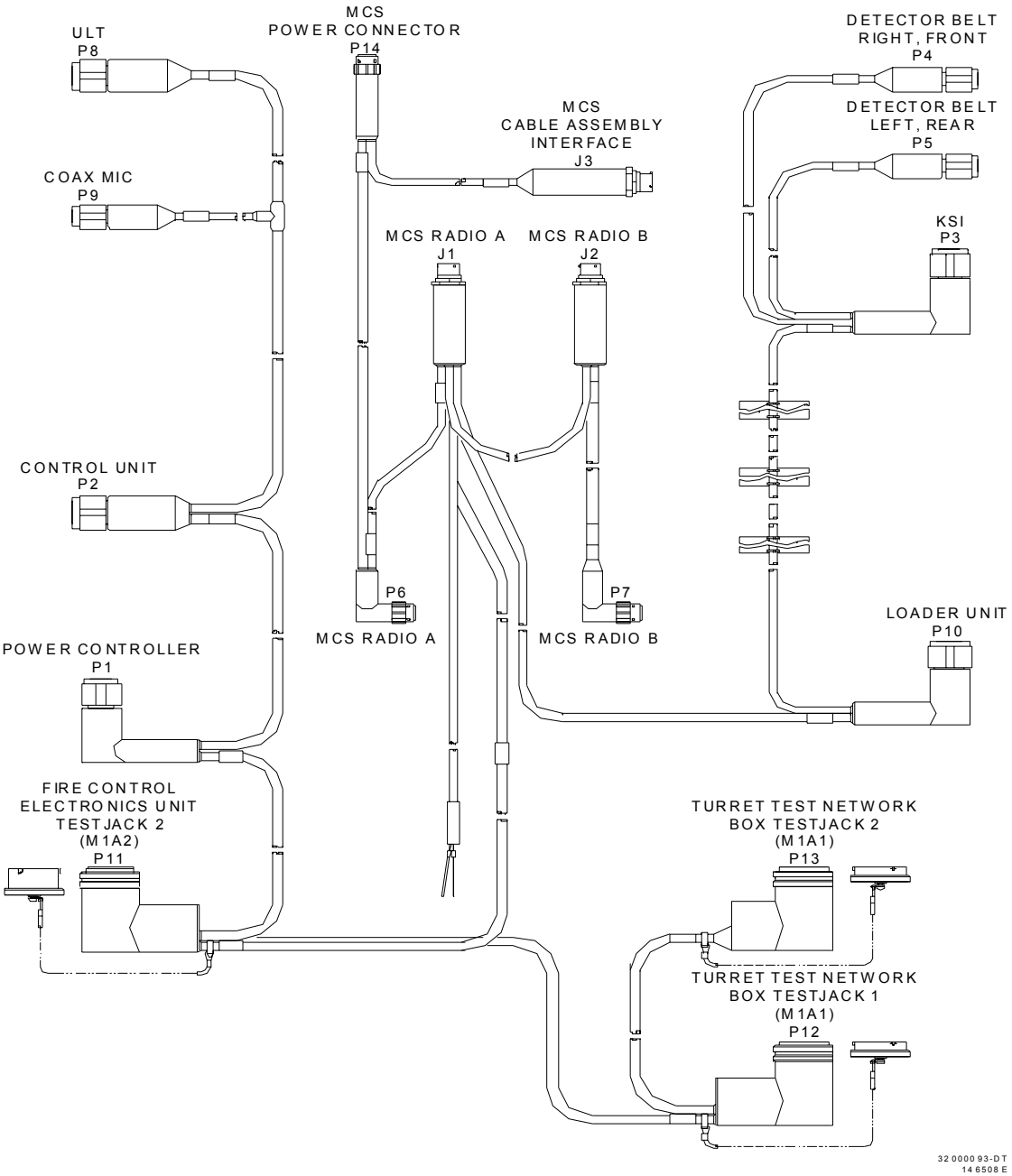


Figure 2-46. M1A1/M1A2 Combined VIS System Cable.

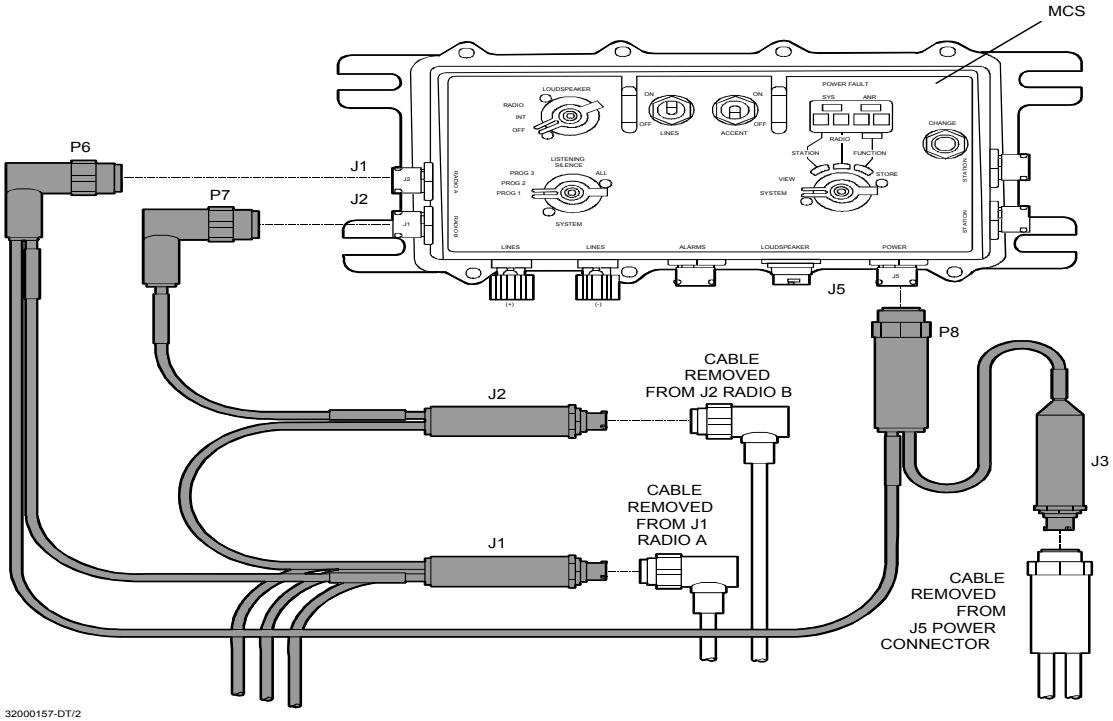


Figure 2-47. M1A1/M1A2 Combined VIS System Cable Connections to MCS.

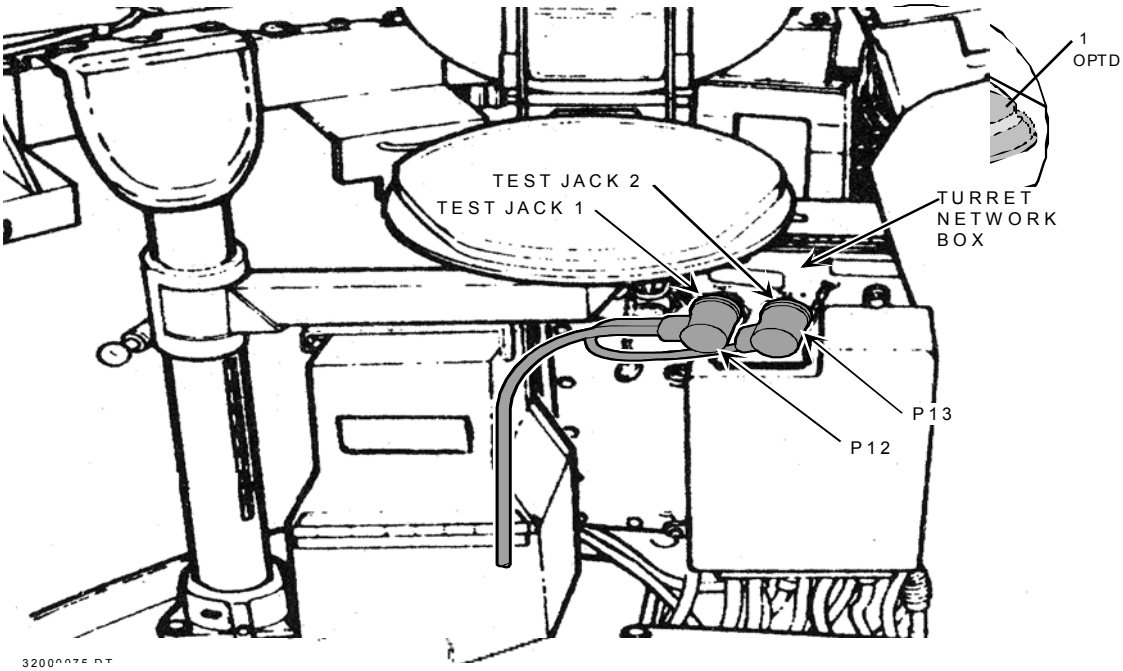


Figure 2-48. M1A1 System Cable connection to Turret Network Box (TNB).

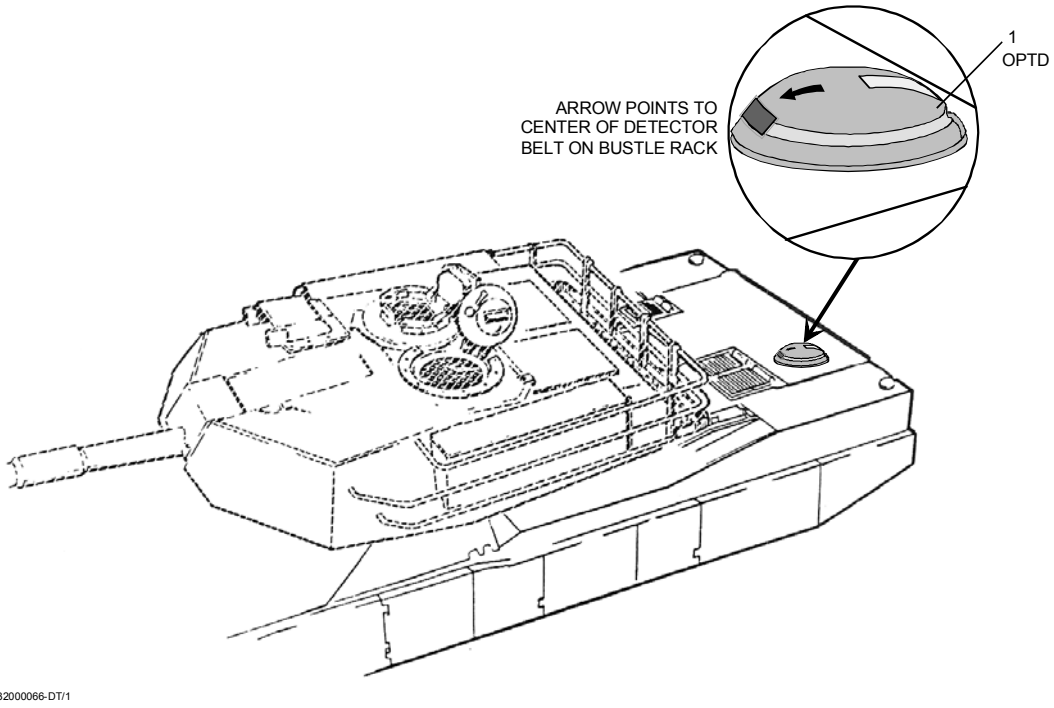


Figure 2-49. M1A1/M1A2 Optical Turret Positioning Device (OTPD) Location.

2.4 INITIAL ADJUSTMENTS, BEFORE USE, DAILY CHECKS, AND SELF-TEST REQUIREMENTS

. Before operating MILES 2000 equipment, perform the following:

a. Ensure that Preventive Maintenance Checks and Services (PMCS) described in Section II have been performed.

b. If there is a DIFCUE installed on the vehicle, load the DIFCUE FU and arm the DIFCUE. (Refer to TD 9-6920-893-10/TM 6920-10/5.)

c. If there is an MGSS installed on the vehicle, load the MGSS FU and arm the MGSS. (Refer to TD 9-6920-892-10/TM 6920/08953A-10/11.)

d. Perform the functional checks described in Section V.

2.5 OPERATING PROCEDURES.

NOTE

Ensure that the Power Controller is fully charged. A Power Controller near discharge will cause either BIT to continuously cycle when the system is powered up, or cause the system to continuously reset. Should this occur, turn the Control Unit (CU) off, start the vehicle and allow the Power Controller to recharge for 15 minutes, or replace the Power Controller.

2.5.1 M1A1/A2 Control Mode on Operating Procedure. Upon power up, the Control Unit (CU) will come up with a vehicle status of "CHEAT KILL," and the KSI will flash continuously. The controller can reset the vehicle status by setting the CD/TDTD for "reset" and firing at a detector on the vehicle. The KSI will flash once and then stop flashing, and the vehicle intercom will sound with "reset." The vehicle may be made mission ready in one of two ways: 1) the controller can set up information for the vehicle and weapons type on the MARS computer and upload the information to the CD/TDTD, then upload the information to the vehicle via the optical port on the KSI; or 2) the controller can set the vehicle status to "Control Mode On," and the required information can be set from the CU.

NOTE

Pressing any other push buttons other than the following four (4) will shut Control Mode Off: Up Arrow, Down Arrow, CTRL/FCTN (red label), and the Enter (red label) push buttons.

2.5.1.1 M1A1 ONLY.

a. Turn the Control Unit (CU) on. MILES 2000 equipment should power up and automatically run BIT. Upon completion, the vehicle intercom sounds with "Audio Check" and indicates whether BIT passed or failed.

NOTE

During BIT, "Switch Test" will be displayed on the CU and Loader Unit (LU). Verify push buttons are working correctly.

b. After the power on BIT completes, the system will be in a "killed" state and will display "CHEAT KILL POWER SOURCE TAMPER" for approximately 7 seconds. The KSI will be flashing continuously. Using the CD/TDTD, reset the system.

c. Time Synch the system using a CD/TDTD. Aim at any detector and pull the trigger.

NOTE

Be sure that you use a CD/TDTD that has been Time Synched by another CD/TDTD. This ensures that all the exercise units and CD/TDTDs have the same date and time.

d. Set the CD/TDTD to Clear Events and place the CD/TDTD into the Kill Status Indicator (KSI) Optical Port and pull the trigger.e. Check the CU events and verify that it has been cleared.

NOTE

The Individual Weapons System (IWS) can be cleared in a similar fashion. Place the CD/TDTD into the Optical Port on the IWS Console (DPCU) and pull the trigger.

f. Time Synch the system using a CD/TDTD. Aim at any detector and pull the trigger. (KSI will flash twice.)

g. Change the vehicle status to "Control Mode On" by setting the CD/TDTD accordingly, aiming at a detector, and pulling the trigger.

h. The KSI will flash once and the CU should display and the vehicle intercom will sound with:

CONTROL MODE ON
(LIMIT 5 MINUTES)

NOTE

The CU will indicate that it is in Control Mode On and that it will be in that mode for five (5) minutes.

i. With a vehicle status of "Control Mode On," perform the following actions:

(1) Press the BIT/CTRL/FCTN push button on the CU.

(2) The CU will display the main menu:

HOST PLATFORM
VEHICLE SIMULATED
WESS SELECTIONS (This applies only to vehicles with weapons, not SATs)

(3) Move the cursor to "HOST PLATFORM" and press ENTER. The CU will display a list of vehicles.

(4) Move the cursor to your vehicle selection and press ENTER. The CU will return to the previous screen.

(5) Move the cursor to "VEHICLE SIMULATED" and press ENTER.

(6) The CU will display:

DEFAULT VEHICLE
CUSTOM VEHICLE

(7) Move the cursor to "DEFAULT VEHICLE" and press ENTER. The CU will display a list of vehicles.

(8) Move the cursor to your vehicle selection and press ENTER. The CU will display the Ammo & Rate Select screen.

(9) The CU will display:

KEYBOARD SELECTED (M1A1 or M1A2)
VEHICLE SELECTED (M1A1/A2 combined)

(10) Move the cursor to "KEYBOARD SELECTED" and press ENTER. The CU will display the Threshold screen.

(11) The CU will display a default threshold of 150 for the M1A1. Press ENTER.

NOTE

Should the vehicle be assessed a Cheat Kill, after a Mobility Kill, due to crew movement, turret movement, engine vibration, etc., ask the Controller to increase the vehicle's threshold level.

(12) The CU will display the "WESS SELECTIONS" screen.

HOST PLATFORM
VEHICLE SIMULATED
WESS SELECTIONS

(13) With the cursor on WESS SELECTIONS, press ENTER. The CU will display the weapons for the vehicle you have selected.

(14) Move the cursor to your WESS Selection and press ENTER. (Refer to Table 2-3 for Wess Selection options.)

(15) Press the WEAPON SELECT push button on the CU. The CU will read "CONTROL MODE OFF," the KSI will flash once, and the vehicle intercom will sound with "Control Mode Off."

2.5.1.2 M1A1/A2 Combined ONLY.

a. Turn the Control Unit (CU) on. MILES 2000 equipment should power up and automatically run BIT. Upon completion, the vehicle intercom sounds with "Audio Check" and indicates whether BIT passed or failed.

NOTE

During BIT, "Switch Test" will be displayed on the CU and Loader Unit (LU). Verify push buttons are working correctly.

Table 2-3. CVS Control Mode "ON."
This is an aid to help you make the proper vehicle selections for the system:

Host Platform	Vehicle Simulated	WESS Selection
M1A1 Abrams	M1A1 105 mm	MGSS Dryfire COAX Blank fire Dryfire
M1A1 Abrams	M1A1 120 mm	MGSS Dry fire COAX Blank fire Dryfire
M1A2 Abrams	M1A2 120 mm	MGSS Dryfire COAX Blank fire Dryfire
M1A1 Abrams	T-80	MGSS Dryfire COAX Blank fire Dryfire
M1A1 Abrams	T-72	MGSS Dryfire COAX Blank fire Dryfire

b. After the power on BIT completes, the system will be in a "killed" state and will display "CHEAT KILL POWER SOURCE TAMPER" for approximately 7 seconds. The KSI will be flashing continuously. Using the CD/TDTD, reset the system.

c. Time Synch the system using a CD/TDTD. Aim at any detector and pull the trigger.

NOTE
Be sure that you use a CD/TDTD that has been Time Synched by another CD/TDTD. This ensures that all the exercise units and CD/TDTDs have the same date and time.

d. Set the CD/TDTD to Clear Events and place the CD/TDTD into the Kill Status Indicator (KSI) Optical Port and pull the trigger.

e. Check the CU events and verify that it has been cleared.

NOTE

The Individual Weapons System (IWS) can be cleared in a similar fashion. Place the CD/TDTD into the Optical Port on the IWS Console (DPCU) and pull the trigger.

f. Time Synch the system using a CD/TDTD. Aim at any detector and pull the trigger. (KSI will flash twice.)

g. Change the vehicle status to "Control Mode On" by setting the CD/TDTD accordingly, aiming at a detector, and pulling the trigger.

h. The KSI will flash once and the CU should display and the vehicle intercom will sound with:

CONTROL MODE ON
(LIMIT 5 MINUTES)

NOTE

The CU will indicate that it is in Control Mode On and that it will be in that mode for five (5) minutes.

i. With a vehicle status of "Control Mode On," perform the following actions:

(1) Press the BIT/CTRL/FCTN push button on the CU.

(2) The CU will display this screen:

HOST PLATFORM
VEHICLE SIMULATED
WESS SELECTIONS (This applies only to vehicles with weapons, not SATs.)

(3) Move the cursor to "HOST PLATFORM" and press ENTER. The CU will display a list of vehicles.

(4) Move the cursor to your vehicle selection and press ENTER. The CU will return to the previous screen.

(5) Move the cursor to "VEHICLE SIMULATED" and press ENTER.

(6) The CU will display:

DEFAULT VEHICLE
CUSTOM VEHICLE

(7) Move the cursor to "DEFAULT VEHICLE" and press ENTER. The CU will display a list of vehicles.

(8) Move the cursor to your vehicle selection and press ENTER. The CU will display the Ammo & Rate Select screen.

(9) The CU will display:

KEYBOARD SELECTED (M1A1 or M1A2)
VEHICLE SELECTED (M1A1/A2 combined)

(10) Move the cursor to "VEHICLE SELECTED" and press ENTER. The CU will display the Threshold screen.

(11) The CU will display a default threshold of 150 for the M1A1. Press ENTER.

NOTE

Should the vehicle be assessed a Cheat Kill, after a Mobility Kill, due to crew movement, turret movement, engine vibration, etc., ask the Controller to increase the vehicle's threshold level.

(12) The CU will display the "WESS SELECTIONS" screen.

(13) With the cursor on WESS SELECTIONS, press ENTER. The CU will display the weapons for the vehicle you have selected.

(14) Move the cursor to your WESS Selection and press ENTER. (Refer to Table 2-3 for WESS Selection options.)

(15) Press the WEAPON SELECT push button on the CU. The CU will read "CONTROL MODE OFF," the KSI will flash once, and the vehicle intercom will sound with "Control Mode Off."

2.5.2 MILES 2000 M1A1/M1A2 BORESIGHT PROCEDURES.

2.5.2.1 M1A1 Boresight Procedures. A modified list of boresighting procedures can be found in the appendices.

a. Install the MILES 2000 equipment on the M1A1.

b. After the Universal Laser Transmitter (ULT) is securely mounted in the main gun breech, remove the adjustment cover from the back of the ULT. Sight through the ULT scope and using the adjustment knobs move the transmitter cross hair so that it is centered down the main gun bore.

NOTE

Refer to the appropriate manual and perform main gun boresight procedures prior to boresighting the MILES 2000 Universal Laser Transmitter (ULT).

c. Have the loader look through the ULT scope and talk the gunner onto a defined aiming point at maximum effective engagement range or at a maximum range of 3000 meters.

NOTE

The maximum effective engagement range is a gunnery term which could mean 3000 meters for a desert operation or 1000 meters for a CTC operation, depending on the terrain and planned operational situation.

d. Use the manual controls to move the aim-point up (use small increments); fire a round at each new aim-point.

e. Find the highest aim-point at which a hit or kill is registered on the target. Depending on the range and the target, the highest aim-point may be above the target. **Mentally note where this aim-point is.**

f. Use the manual controls to move the aim-point to the center of mass of the target.

g. Use the manual controls to move the aim-point down (use small increments); fire a round at each new aim-point.

h. Find the lowest aim-point at which a hit or kill is registered on the target. Depending on the range and the target, the lowest aim-point may be below the target. **Mentally note where this aim-point is.**

i. Use the manual controls to move the aim-point to the center of the hit/kill zone, without moving the manual controls or ULT, use the GPS reticle adjustment toggle switch to center the reticle on the center of mass of the target.

NOTE

The center of the hit/kill zone is midway between the highest and lowest aim-points that got a kill or hit.

j. Fire one (1) round and verify that a hit or kill is registered on the target.

k. Use the manual controls to move the aim-point right (use small increments); fire a round at each new aim-point.

l. Find the aim-point farthest to the right at which a hit or kill is registered on the target. Depending on the range and the target, this aim-point may be to the right of the target. **Mentally note where this aim-point is.**

m. Use the manual controls to move the aim-point to the center of mass of the target.

n. Use the manual controls to move the aim-point left (use small increments); fire a round at each new aim-point.

o. Find the aim-point farthest to the left at which a hit or kill is registered on the target. Depending on the range and the target, this aim-point may be to the left of the target. **Mentally note where this aim-point is.**

p. Use the manual controls to move the aim-point to the center of the hit/kill zone, without moving the manual controls or ULT, use the GPS reticle adjustment toggle switch to center the reticle circle on the center of mass of the target.

NOTE

The center of the hit/kill zone is midway between the left most and right most aim-points that got a kill or hit.

q. Fire one (1) round and verify that a hit or kill is registered on the target.

r. Repeat steps d.-h. and k.-o. to verify that the kill zone is now centered on the target.

NOTE

Refer to the appropriate manual and perform the main gun boresight procedures.

s. Verify boresight using the power control handles to move the gunner's primary sight off the defined aiming point in a "G" pattern and end back on the defined aiming point. With the power control handles depressed, use the GPS to aim at the center of mass of the MILES 2000 target and fire. Verify that the target registers a hit or kill.

t. Replace the adjustment cover on the ULT.

2.5.2.2 M1A2 Boresight Procedures. A modified list of boresighting procedures can be found in the appendices.

a. Install the MILES 2000 equipment on the M1A2.

b. After the Universal Laser Transmitter (ULT) is securely mounted in the main gun breech, remove the adjustment cover from the back of the ULT. Sight through the ULT scope and using the adjustment knobs, move the transmitter cross hair so that it is centered down the main gun bore.

NOTE

Refer to the appropriate manual and align main gun/coax machine gun by completing the "Preparation for manual input" and the "Manual data input steps" prior to boresighting the MILES 2000 Universal Laser Transmitter (ULT).

c. Have the loader look through the ULT scope and talk the gunner onto a defined aiming point at maximum effective engagement range or at a maximum range of 3000 meters.

NOTE

The maximum effective engagement range is a gunnery term which could mean 3000 meters for a desert operation or 1000 meters for a CTC operation, depending on the terrain and planned operational situation.

d. Place a MILES 2000 equipped target at maximum effective engagement range or at a maximum range of 3000 meters. If these ranges are not available, place the target as far away as possible. The closer to 3000 meters, the more accurate the alignment.

e. Select SABOT and use the hydraulic pump handle and manual drive handle to lay the GPS reticle circle onto the center of mass of the MILES 2000 target. Fire (1) one round. A Hit, Kill or Near Miss should be registered at the target.

f. Use the manual controls to move the aim-point up (use small increments); fire a round at each new aim-point.

g. Find the highest aim-point at which a Hit or Kill is registered on the target. Depending on the range and the target, the highest aim-point may be above the target. **Mentally note where this aim-point is.**

h. Use the manual controls to move the aim-point to the center of mass of the target.

i. Use the manual controls to move the aim-point down (use small increments); fire a round at each new aim-point.

j. Find the lowest aim-point at which a Hit or Kill is registered on the target. Depending on the range and the target, the lowest aim-point may be below the target. **Mentally note where this aim-point is.**

k. Use the manual controls to move the aim-point to the center of the Hit/Kill zone, without moving themanual controls or ULT, use the GPS reticle adjustment toggle switch to center the reticle on the center of mass of the target.

NOTE

The center of the Hit/Kill zone is midway between the highest and lowest aim-points that got a Kill or Hit.

l. Fire one (1) round and verify that a Hit or Kill is registered on the target.

m. Use the manual controls to move the aim-point right (use small increments); fire a round at each new aim-point.

n. Find the aim-point farthest to the right at which a Hit or Kill is registered on the target. Depending on the range and the target, this aim-point may be to the right of the target. **Mentally note where this aim-point is.**

o. Use the manual controls to move the aim-point to the center of mass of the target.

p. Use the manual controls to move the aim-point left (use small increments); fire a round at each new aim-point.

q. Find the aim-point farthest to the left at which a Hit or Kill is registered on the target. Depending on the range and the target, this aim-point may be to the left of the target. **Mentally note where this aim-point is.**

r. Use the manual controls to move the aim-point to the center of the Hit/Kill zone, without moving the manual controls or ULT, use the GPS reticle adjustment toggle switch to center the reticle circle on the center of mass of the target.

NOTE

The center of the Hit/Kill zone is midway between the highest and lowest aim-points that got a Kill or Hit.

s. Fire one (1) round and verify that a Hit or Kill is registered on the target.

t. Repeat steps d.-h. and k.-o. to verify that the Kill zone is now centered on the target.

NOTE

Refer to the appropriate manual and perform the remaining main gun alignment procedures

u. Verify boresight using the power control handles to move the gunner's primary sight off the defined aiming point in a "G" pattern and end back on the defined aiming point. With the power control handles depressed, use the GPS to aim at the center of mass of the MILES 2000 target and fire. Verify that the target registers a Hit or Kill.

v. Replace the adjustment cover on the ULT

2.5.3 MILES 2000 M1A1 COMMANDER'S M2 ALIGNMENT PROCEDURES. A MODIFIED LIST OF BORESIGHTING PROCEDURES CAN BE FOUND IN THE APPENDICES.

a. Install the Small Arms Transmitter (SAT) on the cooling jacket of the M2.

b. Enable the SAT using an Individual Weapons System (IWS) Torso Harness. (A crew member's is fine.)

c. Insert the borescope into the receptacle on the SAT. (The borescope reticle now indicates where the SAT laser is pointing.)

d. Use the commander's M2 controls to move machine gun and transmitter so that the borescope reticle is on a defined aiming point at the maximum effective engagement range or at a maximum range of 800 meters.

e. Without moving the machine gun, adjust the M2 reticle so that it is on the same defined aiming point as the borescope.

f. Test the alignment by moving off the defined aiming point in a "G" pattern. Check that the borescope and sight reticles are still aligned when back on the defined aiming point.

g. The M2 alignment is now complete.

h. Remove the borescope from the SAT.

i. Test the alignment by placing a soldier, wearing an IWS, downrange with a MILES 2000 CD/TDTD. Load the M2 with blanks or use the dry fire trigger. Fire at the soldier and verify that the M2 kills the vest.

2.5.4 CONSOLE DISPLAY AT NIGHT OR LIMITED VISIBILITY.

a. Press either of the Arrow push buttons on the CU (or IWS Console (DPCU)). This will light the display for three (3) seconds.

b. Make your selection. Once a push button is pressed, the display will stay lighted for 7.5 seconds (or for 7.5 seconds after the last push button has been pressed).

c. After the last push button is pressed, and 7.5 seconds has elapsed, the display will return to the default screen. The display will then stay lit for another three (3) seconds.

d. When a BIT is run [from power-on (battery replacement) or initiated by the user] the display will stay lit during BIT.

2.5.5 MILES 2000 M1A1/M1A2 LOADING PROCEDURES.

2.5.5.1 M1A1 ONLY.

NOTE

The Coax Machine gun may be fired at any time. You do not have to select it to fire it. Fire weapon using normal procedures.

a. Press the Ammo Select push button on either the CU or LU

b. The CU/LU will display:

APFSDS 28
HEAT 0
MPAT 14
STAFF 0

c. Move the cursor to the type of ammo to be selected and press Enter.

NOTE

When using a M1A1 ONLY System, ammo selection must be made on both the CU and LU and the selection must match. If the ammo selection **DOES NOT** match, the user will get a "Near Miss" when firing at a target.

d. Press the Reload push button.

e. The CU/LU may display (depending on the ammo selected):

Main 1 APFSDS
00001 Rounds

f. Once the ammo has been loaded, the CU and the LU will display the type of ammo loaded.

g. Fire the main gun.

2.5.5.2 M1A1/A2 Combined ONLY.

NOTE

The Coax Machine gun may be fired at any time. You do not have to select it to fire it. Fire weapon using normal procedures.

a. Press the AMMO SELECT push button on either the LU or Vehicle Ammo Selection switch.

b. The CU/LU will display:

APFSDS 28
HEAT 0
MPAT 14
STAFF 0

c. Move the cursor to the type of ammo to be selected and press Enter.

NOTE

When using a M1A1/A2 Combined System, ammo selection must be made on both the LU and Vehicle Ammo Selection switch, and the selection must match. If the ammo selection **DOES NOT** match, the user will get a "Near Miss" when firing at a target.

d. Press the Reload push button.

e. The CU/LU may display (depending on the ammo selected):

Main 1 APFSDS
00001 Rounds

f. Once the ammo has been loaded, the CU and the LU will display the type of ammo loaded.

g. Fire the main gun.

SECTION IV. OPERATION UNDER UNUSUAL CONDITIONS

2.6 ASSEMBLY AND PREPARATION FOR USE UNDER UNUSUAL CONDITIONS

2.6.1 Unusual Environment/Weather. MILES 2000 equipment is ruggedized to withstand extreme changes in temperature, terrain, and environment. Therefore, assembly and preparation in unusual environment/weather should only require the caution necessary to ensure the safety of the operators and other participants.

2.6.2 Fording and Swimming. MILES 2000 equipment is waterproof and ruggedized. Therefore, equipment transport which requires fording and/or swimming should only require caution necessary to safeguard operators and participants, and to maintain control and accountability of the equipment.

2.6.3 Emergency Procedures MILES 2000 equipment requires no additional procedures for emergency situations, as the equipment has been developed to be used for training simulations encompassing a great variety of conditions and levels of threat.

SECTION V. FUNCTIONAL CHECKS

2.7 FUNCTIONAL TEST PROCEDURES.

The functional check for MILES 2000 M1A1/A2 equipment is accomplished by the Built-In-Test (BIT) performed by the Control Unit (CU). It will run the BIT, and the CU display screen will stay lighted during the test. Once the test has been run, the CU will display the results on the screen. Table 3-1 in Chapter 3, Section I, Troubleshooting, contains the list of possible error messages the CU may display with MILES 2000 equipment.

2.7.1 Built-In-Test (BIT). To run the vehicle system BIT, perform the steps in Table 2-4. To run the Individual Weapons System (IWS) BIT, perform the steps in Table 2-5.

Table 2-4. Vehicle System Built-In-Test.

ACTION	INDICATION
Turn Control Unit (CU) on.	CU display should light and stay lighted throughout the test. MILES 2000 equipment should power up. Vehicle intercom sounds with "Audio Check," then indicates BIT pass or failure. The KSI will flash continually. CU will automatically begin the BIT.
"SWITCH TEST" will be displayed on the CU and LU.	User may now test push buttons on CU to ensure the push buttons are working properly.
Press the "WEAPON SELECT" push button on the CU and LU.	The display should read "WEAPON SELECT."
Press the "AMMO SELECT" push button.	The display should read "AMMO SELECT."
Continue to do the switch test until you are satisfied that the push buttons are working properly.	The display should match the label of the push button being pressed. Arrow push buttons should read "UP" or "DOWN."
To continue the BIT, simply stop pressing push buttons.	The unit will automatically continue the BIT without further command.
Read results of BIT. Reset vehicle with CD/TDTD	The display will indicate the following: "CHEAT KILL POWER SOURCE TAMPER" The display will indicate one of the following: **READY** - The equipment has passed the BIT and the mission may be continued. or **BIT PASSED -** Indicates an operational system. or **BIT FAIL (with error message)** - All or part of the equipment has failed the BIT, or the equipment is not present or is not properly connected. Refer to Chapter 3, Section I, Table 3-1 for further action. or **KILLED** - The equipment has suffered a Catastrophic Kill. Contact the Controller.

Table 2-5. IWS Built-In-Test (BIT).

ACTION	INDICATION
For PN 147421, insert battery in Individual Weapons System (IWS) Console (DPCU). This will automatically power up the console.	IWS Console (DPCU) will automatically run the BIT. IWS Console (DPCU) display should light and stay lighted throughout the BIT.
For PN 148245, move (gently shake) the IWS Console (DPCU). This will activate the internal mercury switch and automatically power up the IWS Console (DPCU).	IWS Console (DPCU) will automatically run the BIT. IWS Console (DPCU) display should light and stay lighted throughout the BIT.
"SWITCH TEST" will be displayed.	User may now test push buttons on IWS Console (DPCU) to ensure the push buttons are working properly.
Press the "WEAPON ON/OFF" push button.	The display should read "WEAPON ON/OFF."
Press the "EVENTS" push button.	The display should read "EVENTS."
Continue to do the switch test until you are satisfied the IWS Console (DPCU) push buttons are working properly.	The display should match the label of the push button being pressed. Arrow push buttons should read "UP" or "DOWN."
BIT continues after switch test.	
BIT results.	"PASS" indicates IWS is operational. "FAIL" indicates a problem. Refer to Chapter 3, Section I, Table 3-1.

Intentionally left blank.

CHAPTER 3
OPERATOR MAINTENANCE INSTRUCTIONS

SECTION I. TROUBLESHOOTING

3.1 TROUBLESHOOTING PROCEDURES.

Following are troubleshooting procedures for problems which may be encountered with the MILES 2000 M1A1/A2 configuration. Operator troubleshooting procedures involve identifying a problem and isolating the problem to the most likely piece(s) of equipment. Generally the BIT run by the MILES 2000 Control Unit (CU) identifies most problems within the system and produces an error message to let the user know that there is a problem. Table 3-1 lists the error messages that are available; the MILES 2000 equipment malfunction most likely to cause the error message; and the appropriate action to take to correct the problem. You may notice that, much of the time, the corrective action to be taken to resolve a problem is to remove the malfunctioning equipment and replace it with equipment that is working. This is because the MILES 2000 equipment is designed to need only limited maintenance at the operator and/or unit level. When the removal and replacement of equipment can be efficiently expedited, "down time" can be cut dramatically and participants can quickly return to the mission scenario, allowing them to receive maximum benefit from training. Removal and replacement procedures are located in this chapter in Section II , Operator Maintenance.

WARNING

To prevent personal injury, turn all system power off on the CU before conducting any removal/replacement procedures.

You may encounter equipment problems not addressed in this section. If this is the case, notify the appropriate personnel (a supervisor and/or higher echelon maintenance personnel) as soon as possible.

Table 3-1. MILES 2000 Troubleshooting Chart for M1A1/A2 Configuration.

PROBLEM	PROBABLE CAUSE(S)	ACTION
No power to MILES 2000 - No LEDs lighted on Power Controller.	Connection from System Cable not secure or connectors damaged.	Check System Cable connection at Power Controller, tighten if loose. Ensure connector is not damaged and that there is no debris or foreign objects in connector. Check System Cable connection to vehicle slave receptacle, tighten if loose. Ensure connector is not damaged and that there is no debris or foreign objects in connector.
	Power Controller	Check Power Controller. If no LEDs lighted, remove and replace power controller.
	System Cable	If problem still exists, remove and replace system cable. If problem still exists, refer problem to higher echelon maintenance.
BATTERY POWER LOW LED lighted on Power Controller.	Batteries not fully charged.	Remove and replace Power Controller.
BIT FAILURES	**PROBABLE CAUSE**	**ACTION**
Control Unit (CU) Memory	CU	Remove and replace.
CU RTC	CU	Remove and replace.
CU Voice Chip	CU	Remove and replace.
CU Display	CU	Remove and replace.
NV RAM	CU	Ask controller to check settings for vehicle, to ensure Pk tables are correct, and to ensure that the correct vehicle configuration is loaded. If problem still exists, remove and replace CU.
No Loader Commo	Loader Unit (LU)	Remove and replace.
Loader Memory	LU	Remove and replace.
Loader Display	LU	Remove and replace.

Table 3-1. MILES 2000 Troubleshooting Chart for M1A1/A2 Configuration - Continued.

PROBLEM	PROBABLE CAUSE(S)	ACTION
No Universal Laser Transmitter (ULT) Commo	ULT	Check connections; Retest. If error is repeated, remove and replace.
ULT EPROM	ULT	Remove and replace.
ULT Memory	ULT	Remove and replace.
ULT Laser	ULT	Remove and replace.
ULT COAX No Blank	ULT	Load blanks.
No Kill Status Indicator (KSI) Commo	KSI	Check connections; Retest. If error is repeated, remove and replace.
KSI Memory	KSI	Remove and replace.
Strobe	KSI	Check connections; Retest. If error is repeated, remove and replace.
Optical Turret Positioning Device (OTPD) Battery Low	OTPD	Replace battery with standard 9 Volt battery. Retest. If error is repeated, remove and replace.

Table 3-1. MILES 2000 Troubleshooting Chart for M1A1/A2 Configuration - Continued.

PROBLEM	PROBABLE CAUSE(S)	ACTION
No Optical Turret Positioning Device (OTPD) data.	OTPD	Check position of OTPD to ensure it is properly placed; Retest. If error is repeated, replace the OTPD battery with a standard 9-Volt battery. Retest. If an error is repeated, remove and replace.
Right Belt	Detector Belts	Remove and replace right from detector belt.
Individual Weapons Systems (IWS) Display	IWS Console (DPCU)	Check connections; Retest. If error repeats, remove and replace Torso Harness.
IWS Memory	IWS	Remove and replace Torso Harness.
IWS Detector/AMP	IWS	Remove and replace Torso Harness.

SECTION II. OPERATOR MAINTENANCE

3.2 OPERATOR MAINTENANCE PROCEDURES.

Much of the operator maintenance for the MILES 2000 equipment consists of removing the defective item and replacing it with functioning equipment. Remove/Replace procedures for the M1A1/A2 configuration are included below:

WARNING

To prevent personal injury, turn all power off before conducting any removal/replacement procedures.

3.2.1 Remove/Replace Procedures for Individual Weapons System (IWS). Before conducting any remove/replace procedures, turn all power OFF.

3.2.1.1 CVC Helmet Harness Assembly Removal.

a. Loosen the harness ends.

b. Detach each fastener strip of the harness from the helmet.

c. Remove the harness from the helmet.

d. Clean the harness and place it in the transit case.

e. Fill out the appropriate form stating the problem and place the form in the transit case with the equipment.

3.2.1.2 CVC Helmet Harness Assembly Replacement.

a. Adjust the harness so the three (3) patches of fastener tape inside line up with the (3) three pieces on the helmet. Ensure there are no wrinkles or twists in the harness.

b. Press the tape on the harness firmly against the tape on the helmet.

3.2.1.3 Torso Harness Assembly Removal.

a. Remove the Torso Harness.

b. Remove the battery from the IWS Console (DPCU), (PN 147421 only.)

CAUTION

Ensure battery door is securely closed during storage and operations, or damage can occur to the battery door.

c. Clean the equipment and prepare for turn in.

3.2.1.4 Torso Harness Assembly Replacement.

a. Locate the IWS Console (DPCU) on the Torso Harness.

b. For PN 147421, install the 9-volt battery in the IWS Console (DPCU) by loosening the thumbscrew and opening the battery door. Insert battery and secure the battery door using the thumbscrew.

CAUTION

Ensure battery door is securely closed during storage and operations, or damage can occur to the battery door.

3.2.2 Remove/Replace Procedures for M1A1/A2. Before conducting any remove/replace procedures, turn all power OFF.

3.2.2.1 M240 Small Arms Transmitter (SAT) Removal.

a. Unclip the SAT adapter from the barrel of the M240 machine gun.

b. Remove the SAT and adapter from the gun barrel, taking care not to damage the equipment.

c. Clean the equipment and adapter and prepare for turn in.

3.2.2.2 M240 Small Arms Transmitter (SAT) Replacement.

a. Inspect the mounting bracket; make sure the SAT is securely mounted to the bracket.

b. Slide the SAT and adapter over the barrel of the M240 and secure the clip to the barrel.

c. Torque to 60 inch-pounds.

3.2.2.3 M2 Small Arms Transmitter (SAT) Removal.

a. Detach the SAT adapter clamp from the barrel of the M2 machine gun.

b. Remove the SAT and adapter from the gun barrel, taking care not to damage the equipment.

c. Clean the equipment and adapter and prepare for turn in.

3.2.2.4 M2 Small Arms Transmitter (SAT) Replacement.

a. Inspect the mounting bracket; make sure the SAT is securely mounted to the bracket.

b. Slide the SAT and adapter over the barrel of the M2 and secure the clamp to the barrel.

c. Torque to 85 inch-pounds.

d. Align SAT using the ASAAF (**M1A2 ONLY**).

3.2.2.5 Right Front Detector Belt Removal.

a. Disconnect the System Cable from the detector belt connector.

b. Working with short sections, detach the detector belt from the fastener tape on the vehicle. Work carefully so that no electronics or wiring are damaged during removal.

c. Clean equipment and prepare for turn in.

3.2.2.6 Right Front Detector Belt Replacement.

a. Working in short sections, press the detector belt against the fastener tape. Work carefully so that no electronics or wiring are damaged during replacement.

b. Once the belt is installed, attach the System Cable connector to the belt connector.

c. Safely secure cable using fastener tape tie-wraps.

3.2.2.7 Left Rear Detector Belt Removal.

a. Disconnect the System Cable from the detector belt connector.

b. Working with short sections, detach the detector belt from the fastener tape on the vehicle. Work carefully so that no electronics or wiring are damaged during removal.

c. Clean equipment and prepare for turn in.

3.2.2.8 Left Rear Detector Belt Replacement.

a. Working in short sections, press the detector belt against the fastener tape. Work carefully so that no electronics or wiring are damaged during replacement.

b. Once the belt is installed, attach the System Cable connector to the belt connector.

c. Safely secure cable using fastener tape tie-wraps.

3.2.2.9 Kill Status Indicator (KSI) Removal.

a. Disconnect the System Cable from the KSI connector.

b. Disengage the rubber latches on the mast adapter assembly from the latching brackets on the KSI.

c. Pull the KSI away from the mast adapter assembly, taking care not to damage the equipment.

d. Clean equipment and prepare for turn in.

3.2.2.10 Kill Status Indicator (KSI) Replacement

a. Apply fastener tape to the KSI if there is none.

b. Match the KSI latching brackets to the upper mounting adapter latch positions and secure the KSI to the adapter with the fastener tape.

c. Secure the rubber latches from the mounting adapter to the latching brackets on the KSI.

d. Connect the System Cable to the KSI.

3.2.2.11 MGSS FU Removal. Refer to TD 9-6920-892-10/TM 6920-08953A-10/11 for MGSS removal instructions.

3.2.2.12 MGSS FU Replacement. Refer to TD 9-6920-892-10/TM 6920/08953A-10/11 for MGSS replacement instructions.

3.2.2.13 DIFCUE Removal. Refer to TD 9-6920-893-10/TM 6920-10/5 for DIFCUE removal instructions**.**

3.2.2.14 DIFCUE Replacement. Refer to TD 9-6920-893-10/TM 6920-10/5 for DIFCUE replacement instructions.

3.2.2.15 Coax Microphone Removal.

a. Disconnect the System Cable from the Coax Mic.

b. Unclip the Coax Mic from the machine gun barrel, taking care not to damage the equipment.

c. Detach fastener tape securing Coax Mic Cable to the vehicle and remove the cable and Coax Mic.

d. Clean the equipment and prepare for turn in.

3.2.2.16 Coax Microphone Replacement.

a. Feed the Coax Mic and cable through the main gun breech. Leave the connector end of the cable at the mouth of the main gun breech.

b. Clip the Coax Mic to the machine gun barrel. Ensure that the Coax Mic Cable is not in contact with the barrel.

c. Secure the cable out of the way as needed.

3.2.2.17 Universal Laser Transmitter (ULT) Removal.

a. Disconnect the System Cable from the ULT.

b. Remove the two (2) bolts holding the adapter to the main gun breech and set them aside.

c. Remove the ULT and adapter from the main gun breech. Fasten the two (2) bolts to the mounting holes in the top of the adapter.

d. Clean the equipment and prepare for turn in.

3.2.2.18 Universal Laser Transmitter (ULT) Replacement.

a. Remove the two (2) bolts from the top of the ULT adapter; keep them with you.

b. Holding the ULT/adapter at a 45E angle, slide the ULT/adapter into the main gun breech (with the ULT connector facing towards the installer), and slide the adapter tabs over the flanges on each side of the breech.

c. Ensure the mounting holes on the top of the adapter are lined up with the mounting holes on top of the breech. Using the bolts you removed from the adapter, bolt the adapter to the breech and ensure that it is secure.

d. Torque front bolts to 45 inch-pounds and connect the System Cable to the ULT connector.

3.2.2.19 Control Unit (CU) Removal.

a. Disconnect the System Cable from the CU.

b. Detach the CU from the vehicle, taking care not to damage the equipment.

c. Clean the equipment and prepare for turn in.

3.2.2.20 Control Unit (CU) Replacement.

a. Apply fastener tape to the CU if there is none attached.

b. Mount the CU on the vehicle.

c. Connect the System Cable to the CU connector.

3.2.2.21 Power Controller Removal.

a. Disconnect the System Cable from the Power Controller.

b. Detach the Power Controller from the vehicle, taking care not to damage the equipment.

c. Clean the equipment and prepare for turn in.

3.2.2.22 Power Controller Replacement.

a. Apply fastener tape to the bottom of the Power Controller if there is none attached.

b. Attach the Power Controller to the vehicle.

c. Connect the System Cable to the power controller connector.

3.2.2.23 Loader Unit (LU) Removal.

a. Disconnect the System Cable from the Loader Unit.

b. Detach the unit from the fastener tape on the vehicle, taking care not to damage the equipment.

c. Clean the equipment and prepare for turn in.

3.2.2.24 Loader Unit (LU) Replacement.

a. Apply fastener tape to the back of the unit if there is none attached.

b. Attach the LU to the fastener tape on the vehicle.

c. Connect the System Cable to the Loader Unit connector.

3.2.2.25 System Cable Removal.

a. Disconnect cable from all units and other cables.

b. Detach the fastener tape securing the cable to the vehicle.

c. Remove the cable, taking care not to damage the cable or connectors.

d. Clean the cable and prepare for turn in.

3.2.2.26 System Cable Replacement.

a. Replace the cable using the instructions in Chapter 2.

b. Secure the cable to the vehicle using fastener tape tie-wraps.

3.2.2.27 Optical Turret Positioning Device (OTPD) Removal.

a. Detach the OTPD from the vehicle, taking care not to damage the equipment.

b. Clean the equipment and prepare for turn in.

3.2.2.28 Optical Turret Positioning Device (OTPD) Replacement.

a. Apply fastener tape to the bottom of the OTPD if there is none.

b. Position the OTPD so the arrow points to the center of the detector belt on the bustle rack.

CAUTION

Ensure battery door is securely closed during storage and operations, or damage can occur to the battery door.

c. Run BIT to verify correct position of OTPD. (Reposition if necessary.)

d. Attach the OTPD to the vehicle.

WARNING

To prevent personal injury, turn all power off before conducting any removal/replacement procedures.

3.3 MILES 2000 EQUIPMENT DISASSEMBLY PROCEDURES.

Perform the following procedures to remove and store the M1A1/A2 equipment. Always ensure that all power to the equipment is OFF before disassembly.

3.3.1 Disassembly Procedures for M1A1/A2.

a. Disconnect System Cable and remove it and all MILES 2000 equipment in accordance with the removal procedures in Section II of this chapter.

b. Remove batteries from applicable equipment.

c. Clean and inspect equipment. If there is any damage to the equipment, report damage on the appropriate form (a separate form for each piece of equipment) and turn in with damaged equipment.

d. Place equipment and System Cable(s) in the Transit Case.

Intentionally left blank

APPENDIX A

M1A1 MILES 2000 BORESIGHT PROCEDURES

BORESIGHT THE SYSTEM AT THE MAX ENGAGEMENT RANGE, OR AT A MAX RANGE OF 3000 METERS.

1. Make sure the ULT is securely mounted in the main gun breach.
2. Remove the adjustment cover from the rear of the ULT.
3. Look through the scope and using the adjustment knobs move the transmitter cross hair so that it is centered in the main gun bore.
4. Turn on turret power, turn TIS to STBY, ammo select switch to SABOT, gun select switch to MAIN, fire control mode to emergency.
5. Check emergency mode drift, null if necessary.
6. Set fire control mode switch NORMAL, check and null normal mode drift.
7. Open CCP door and turn on computer, open cover and press SUB DES key, enter AMMO SUBDES 59, press enter key.
8. Press boresight key and record data, enter 0.0, 0.0, press enter key.
9. Press ZERO key and enter 0.0, 0.0, press enter key.
10. Set ammo select switch to HEAT, press the ZERO key and enter 0.0, 0.0, press enter key.
11. Set gun select switch to COAX, press the boresight key, enter 0.0. 0.0, press enter key, press the ZERO key and enter 0.0, 0.0, press enter key.
12. Set gun select switch back to MAIN, set ammo select switch back to SABOT.
13. Press RANGE key, enter 1200, (no matter what the range to the boresight target is), press enter key, engage gunner's control handles for five seconds and release.
14. Set fire control mode switch to manual.
15. Press the BORESIGHT key.
16. Using manual controls, have a crew member look through the ULT scope and talk the gunner onto a defined aiming point.
17. Without moving the main gun, toggle the UPS reticle onto the same defined aiming point.
18. Using the GAS boresight knobs adjust the 1200m reticle line onto the same defined aiming point.
19. Set FLT/CLR/SHTR switch to SHTR, set TIS switch to on.
20. Unlock TIS boresight knobs and adjust TIS reticle onto the defined aiming point.
21. Set TIS to STBY, Set FLT/CLR/SHTR switch to CLR. Looking through the GPS use manual controls to lay off and back on the aiming point in a "G" pattern, confirm that all sights are still on the aiming point.
22. Record the main gun boresight data, press the enter key, reinstall the ULT adjustment cover.
23. Set gun select switch to COAX, press the boresight keys enter the numbers from the main gun boresight into the COAX boresight, press the enter key.
24. Set fire control mode switch to NORMAL.
25. Fire at a MILES instrumented target at max engagement range to verify a kill.

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS **For use of this form, see AR 310-1; the proponent agency is the US Army Adjutant General Center.**	Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE
TO: *(Forward to proponent of publication or form) (Include ZIP Code)*	**FROM:** *(Activity and location) (Include ZIP Code)*	

PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE

ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO.*	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON *(Exact wording of recommended change must be given)*

** Reference to line numbers within the paragraph or subparagraph.*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

DA FORM 1 FEB 74 **2028** REPLACES DA FORM 2028, 1 DEC 68, WHICH WILL BE USED.

TO: *(Forward to proponent of publication or form) (Include ZIP Code)*	**FROM:** *(Activity and location) (Include ZIP Code)*	**DATE**

PART II- REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION/FORM NUMBER	DATE	TITLE

PAGE NO.	COLM NO.	LINE NO.	FEDERAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPROTED	RECOMMENDED ACTION

PART III - REMARKS ***(Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)***

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

☆U.S. GOVERNMENT PRINTING OFFICE 1981 341-646/8606